



PART IV

Groundwater Assessment

Section 106(e) of the Clean Water Act (CWA) requires state reporting on the status of their groundwater resources to Congress every two years in the biennial CWA 305(b) report. For the 1998 report and subsequent editions, EPA has required aquifer specific assessments for groundwater resources. To meet EPA expectations, the aquifer specific assessments will be done in three phases and will be described in more detail in later sections of this report. The information provided in the report will be comprise of three levels of detail.

- 1) Level 1 provides an overview in a broad statewide perspective and includes:

- C Part 4 Overview of State Groundwater Assessments

- C Chapter 4-1 Overview of Groundwater Contamination Sources and Groundwater Quality

- 2) Level 2 provides more detail of State activities:

- C Chapter 4-2 Overview of Groundwater Protection Programs

- 3) Level 3 provides information on specific assessment findings and includes:

- C Chapter 4-3 Summary of Groundwater Contamination Sources

- C Chapter 4-4 Summary of Groundwater Quality

The Groundwater Protection Program (GWPP) has engaged in preliminary assessment activities and under the direction of the Department of Health's Safe Drinking Water Branch (SDWB) will be responsible for reporting on the groundwater assessments in this section of the 1998 CWA 305(b) Report.

Chapter 4 Groundwater Assessment is comprised of the following topic areas:

- C Groundwater Assessment Phases

- C Aquifer Identification and Classification

- C The Hawaii Wellhead Protection Program

- WRRC Wellhead Protection Methodology For Hawaii

- Horsely & Witten's Molokai Wellhead Protection Study

- Matthew Hagemann's Central Oahu Wellhead

Vulnerability Report



- Matthew Hagemann's Maui Wellhead Vulnerability Report

Groundwater Assessment Phases

For the 1998 Report, EPA has required the use of comprehensive aquifer information that goes beyond the reporting of groundwater resources and contamination detection inventories. Because Hawaii is a groundwater dependent region, where over 90% drinking water sources are from groundwater, the State is concerned about the quality of and status of our aquifers. The information that is needed to implement a comprehensive assessment and protection strategy is not readily available and often fragmented among several intergovernmental agencies. To meet the immense requirements for comprehensive data, DOH will implement three phases in statewide groundwater assessments to meet the goal of having 75% or more of the state assessed by year 2006.

Table 5.A Hawaii Groundwater Assessment Phases

Phase	Data Source(s)	305(b) Reporting Period
Phase I	Hawaii Aquifer Classifications, Hawaii Wellhead Protection Program Vulnerability Assessments, 1997 Groundwater Contamination Maps, and drinking water monitoring data	1998 CWA 305(b) Report
Phase II	HISWAP data on public drinking water sources, subsequent Groundwater Contamination Maps, and drinking water monitoring data	2000 and 2002 CWA 305(b) Reports
Phase III	HISWAP data, ambient groundwater data, field survey updates, subsequent Groundwater Contamination Maps, and drinking water monitoring data	2004 and subsequent CWA 305(b) Reports

Phase I assessments utilize existing information from DOH aquifer research and wellhead protection assessments, where information from specific assessment areas are used for the 1998 CWA 305 (b) Report. Another data resource is the annual Groundwater Contamination Maps for the State of Hawaii that provide an overview of detected organic chemical contamination in the state. Together these respective studies provide an overview of the aquifers in the state, locations of



where contaminants have been detected, and specific aquifer/wellhead areas that have been assessed for vulnerability to contamination.

Phase II assessments will be based upon data generated from the Hawaii Source Water Assessment Program (HISWAP). HISWAP is currently under development, and statewide source water assessments are planned to be completed by year 2003. Phase II information will provide comprehensive data on public drinking water sources that will identify source water protection areas (SWPA), contamination sources in SWPAs, and the susceptibility of SWPAs to their contamination sources. With this information and the State Groundwater Contamination Maps, more comprehensive information about public drinking water sources can be reported and assessed.

Phase III assessments will include all completed HISWAP assessments, and any ambient groundwater data that will be collected and/or analyzed. Phase III intends to have a comprehensive database of public drinking water sources and ambient groundwater data. The progress in this phase will depend upon pending policy and budget decisions.

The following sections describe the aquifer identification study, the wellhead vulnerability studies, and the Groundwater Contamination Maps. In each study the associated project is described, and the methodology used. The findings from the wellhead studies will be described in more detail in the sections summarizing groundwater contamination and quality.

Aquifer Identification and Classification

From 1990 to 1993, aquifers in the State were identified and classified. DOH had contracted the Water Resources Research Center (WRRRC) from the University of Hawaii for the aquifer project, and the principal investigators were John M. Mink and L. Stephen Lau. The WRRRC had identified general aquifer sectors and smaller aquifer systems for the islands of Kauai, Oahu, Molokai, Lanai, Maui, and Hawaii. Each aquifer system was divided into aquifer types that were characterized with hydrologic factors such as basal, high level, unconfined, confined, and confined/unconfined conditions, and geologic factors such as flank, dike, perched,



sedimentary, or combination aquifer types. They also identified the status of the aquifer types through identification of their development stages, potability/salinity, utility, uniqueness, and vulnerability to contamination. The vulnerability determination applied in this study was based upon geographical limits of the resource, interconnection among groundwater sources, relatively rapid time of groundwater travel, and familiarity with environmental conditions.¹ Vulnerability was ranked as high, moderate, or low. Refer to Map 5.1 and Figure 5.1 for examples of their identification and classification.

The aquifer study described that aquifer types have varying levels of vulnerability to contamination. Aquifers contained or confined by caprock are less prone to contamination whereas unconfined aquifers are highly vulnerable to contamination.² Table 5.b shows the amount of aquifer units and subunits and correlates the unconfined aquifer and vulnerability relationship. The aquifers on Oahu, Molokai, Lanai, and Hawaii have a strong correlation with the unconfined aquifer and vulnerability relationship. On Kauai and Maui the relationship is not as evident as they have lower percentages of aquifers vulnerable to contamination, and they contain a significant number of aquifer systems that contain both perched and flank/dike aquifers that overlay each other.

The WRRC studies have provided a comprehensive profile of the location, composition, characteristics, and vulnerability of Hawaii's aquifers. This information provides insight of how our aquifers are formed and the natural conditions that may or may not protect them from anthropogenic impacts. To supplement this data, investigations on surrounding land use activities and their existing and potential impacts to groundwater quality are needed. Understanding how aquifers work and what activities may contaminate them provides the basis for protection policies and efforts. The Hawaii Wellhead Protection Program and the Hawaii Source Water Assessment and Protection Programs will provide the application of assessment information necessary for policy and regulatory decision making.



Table 5.B The Number of Aquifers in Hawaii

Island	Number of Aquifer Sectors	Number of Aquifer Systems	Number of Aquifer Types	Number of unconfined aquifers	Number and % of Aquifer Types Highly Vulnerability to Contamination	
Kauai	3	13	120	98	77	64%
Oahu	6	24	90	66	66	73%
Molokai	4	16	60	60	59	98%
Lanai	4	9	22	22	22	100%
Maui	6	25	113	106	72	64%
Hawaii	9	24	82	82	69	84%

Insert Map 5.1
And Figure 5.1



The Hawaii Wellhead Protection Program

The 1986 Safe Drinking Water Act Amendments defines a wellhead protection area as “the surface and subsurface area surrounding a water well or wellfield, supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water well or wellfield.” In 1995, the Hawaii Wellhead Protection Program (HWHPP) was formerly approved by EPA. HWHPP is comprised of the program elements of delineation of wellhead protection areas (WHPAs), inventory of contamination sources within the WHPAs, development of management measures, development of contingency plans, and an infrastructure of stakeholder workgroups involved in the WHPAs. In this section, several studies are discussed: WRRC wellhead methodology study, Horsely & Witten’s Molokai wellhead protection area study, and Matthew Hagemann’s Central Oahu and Maui wellhead vulnerability studies.

WRRC Wellhead Protection Methodology For Hawaii

In April 1992, WRRC had completed research on appropriate wellhead protection methodology for Hawaii.³ They had identified the necessary elements for establishing WHPAs as criteria, criteria thresholds (the factor that determines the size of the WHPA), and delineation methods. The criteria and criteria thresholds they recommended were distance, time of travel, and flow-boundaries. They had identified that a simple delineation technique should be applied because Hawaii has complex hydrologic characteristics where infiltration and contaminant transport is more horizontal than vertical due to lava inclusions. They also stated that the lack of detailed hydrological information precludes the use of sophisticated delineation techniques.

They recommended that selected delineation methods should reflect protection policy decisions and using a sequential approach where subsequent protection areas would be larger if greater need for protection was appropriate. Their ideal protection area would be an aquifer protection area (APA) that encompasses the entire recharge area of a well. But they identified the limitations to APA as creating conflicts with land owners and inconsistent protection of adjacent and hydrologically linked aquifers. Subsequent wellhead studies had used the WRRC methodology study as the basis of respective wellhead delineation methods.



The DOH Molokai Wellhead Protection Study

In December of the same year Horsely & Witten, Inc., environmental consultants, completed a wellhead study on Molokai.⁴ The study provides useful information about basic groundwater hydrology, contamination characteristics and transport, delineation and mapping applications, and regulatory and non-regulatory approaches to wellhead protection.

Horsely and Witten held community workshops and discussed possible delineation approaches. They concurred with WRRC that Hawaii is hydrologically complex, and that hydrogeologic data for Molokai is limited, so a simple semi-analytical groundwater flow model should be used. With community input, they agreed upon a model that can be applied to multiple wells with a twenty five year time of travel. The model used was EPA's WHPA Code, General Particle Tracking Module which plotted a series of groundwater flow lines from the well to the twenty five year zone of capture boundary. Three WHPAs and one aquifer protection area were identified. Refer to Map 5.2 for the WHPA locations and Table 5.d for well listing and coordinates. Although WRRC aquifer studies had identified that the aquifers on Molokai are unconfined and vulnerable to contamination, DOH drinking water monitoring data have not identified detections of SOC, VOC, or other organic contaminants. This does not mean that there are no groundwater concerns for the island of Molokai.

DOH, through program and resource limitations, have not yet initiated a comprehensive review of past and current land use activities, solicitation of available ambient groundwater data, and interviews with residents on potential or suspected contamination sources. Since the wellhead study on Molokai, a community workgroup called the Hui Palekana Wai Inu o Molokai has formed and is initiating education and outreach efforts. The workgroup has started to compile some information on contamination sources and established some management measures. We will report on any new information in the year 2000 and subsequent 305(b) Reports.

Insert Map 5.2

Table 5.D Description of Molokai Wells and Locational Data

Wellhead Protection Area	Wells	Latitude	Longitude
Kualapuu	Kaluakoi Corp (4-0901-01)	210903	1570130
	Kauluwai (4-0801-01)	210856	1570112
	Kauluwai #2 (4-0801-02)	210857	1570107
	Maui DWS (4-0801-03)	210857	1570117
Kawela	Kawela Shaft (4-0457-01)	210419	1565705
	Kawela #1 (4-0456-08)	210426	1565635
	Kawela #2 (4-0456-09)	210419	1565621
	Kawela #3 (4-0456-06)	210429	1565651
Ualapue	Ualapue Shaft (4-0449-01)	210402	1564958
Waikolu Aquifer Protection Area	Waikolu Tunnel Well (4-0855-01)	210827	1565533
	Waikolu Valley #1 (4-0855-02)	210847	1565519
	Waikolu Valley #2 (4-0855-03)	210839	1565514

The DOH Central Oahu Wellhead Vulnerability Report

In 1995, DOH had contracted Matthew Hagemann, EPA's hydrogeologist, to perform wellhead delineations and assessment for the Central Oahu region of the island of Oahu.⁵ The delineations were the initial step in a HWHP demonstration project for the island. The report had identified four wellhead protection areas extending from Pearl Harbor to Schofield Barracks and to Haleiwa. Map 5.3 shows the locations of the WHPAs in the Central Oahu region and Table 5.E lists the wells, their USGS number and coordinates as they are located in their respective aquifer sectors and systems.



This project area was chosen because:

- Ⓒ past contamination of public water supply wells in the project area indicated significant groundwater vulnerability;
- Ⓒ numerous and significant sources of identified groundwater contamination;
- Ⓒ the wells in the project area constitute significant public water supplies for the island of Oahu; and
- Ⓒ sufficient data was available for the Central Oahu region.

The methodology used for the WHPA delineations was similar to the approach that Horsely & Witten used. A mathematical model, WHPA version 2.0 (U.S. EPA, 1991) was used and a ten year time of travel to model public water supply well capture zones or WHPAs. The multiple well capture zone (MWCAP) module from the model was used because it enabled the characterization of groundwater flow from multiple wells and it allowed for the representation of a no-flow boundary. Model output was applied to GIS data to provide spatial characterization of WHPAs, drinking water wells, and geographic features.

EPA defines vulnerability as:

“the relative ease with which a contaminant applied on or near the land surface can migrate to the aquifer of interest..”

To assess the WHPA’s vulnerability to contaminants, its aquifer sensitivity or hydrogeological characteristics was characterized using WRRC data, and then sources of contamination were identified within the WHPAs. Hagemann worked with DOH to apply GIS to combine map coverages of the WHPAs, and land use and contamination data comprising of state land use districts, underground storage tank locations, water quality maps, and hazardous waste sites. As data coverages were layered they assessed the vulnerability of each WHPA with information on reported incidences of contamination and identified and potential sources of contamination. The vulnerability assessment for each WHPA was ranked using the following scheme: **Insert Map 5.3**

Table 5.E Description of Central Oahu Wells and Locational Data



Wellhead Protection Area (WHPA) Aquifer Sector/System	Wells			Latitude	Longitude
WHPA I Pearl Harbor/ Kunia & Waipahu & Waiawa	Mililani I:	P1	(2800-01)	212803	1580007
		P2	(2800-02)	212803	1580007
		P3	(2800-03)	212803	1580007
		P4	(2800-04)	212803	1580007
	Mililani II:	P1	(2859-01)	212829	1575933
		P2	(2859-02)	212830	1575933
	Mililani III:	#1	(2600-03)	212659	1580044
		#2	(2600-04)	212659	1580042
	Waipio Hts:	#1	(2459-20)	212428	1575953
		#2	(2459-19)	212427	1575952
	Waipio Hts I:	#3	(2459-23)	212426	1575952
		#4	(2459-24)	212425	1575952
	Waipio Hts II:	#1	(2500-01)	212522	1580030
		#2	(2500-02)	212522	1580030
	Waipio Hts III:	#1	(2659-02)	212640	1575953
		#2	(2659-03)	212639	1575952
	Waipahu Wells:	P1	(2400-02)	212415	1580026
		P2	(2400-01)	212415	1580026
		P3	(2400-03)	212415	1580026
		P4	(2400-04)	212415	1580026
	Waipahu II:	#1	(2400-06)	212414	1580053
		#2	(2400-05)	212414	1580053
	Hoeaie Well 1:	P1	(2301-34)	212321	1580137
		P2	(2301-35)	212321	1580137
		P3	(2301-36)	212321	1580137
		P4	(2301-37)	212321	1580137
		P5	(2301-38)	212321	1580137
		P6	(2301-39)	212321	1580137
	Dairy Company		(2600-02)	212601	1580041
	Kunia I:	P1	(2303-01)	212318	1580208
		P2	(2303-02)	212318	1580208
		P3	(2303-03)	212316	1580205
		P4	(2303-04)	212316	1580205
	Kunia II:	P1	(2402-01)	212410	1580231
		P2	(2402-02)	212408	1580230
		P3	(2402-03)	212409	1580227
	Hawaii Country Club		(2603-01)	212618	1580338
WHPA II & III Central/Wahiawa	Del Monte Pump 3		(2803-05)	212838	1580327
	Wahiawa Wells:	P1	(2901-11)	212946	1580141
		P2	(2901-12)	212945	1580142
		P3	(2901-08)	212944	1580143
	Wahiawa 2		(2902-02)	212948	1580218



Wellhead Protection Area (WHPA) Aquifer Sector/System	Wells	Latitude	Longitude
	Schofield Battery: (2901-02) (2901-03) (2901-04) (2901-06) (2901-07) (2901-10)	212927 212927 212927 212927 212927 212927	1580148 1580148 1580148 1580148 1580148 1580148
WHPA IV North/Waialua	Haleiwa 1 (3405-03)	213449	1580542
	Haleiwa 2 (3405-04)	213448	1580543
	Waialua Wells: P1 (3405-01)	213428	1580557
	P2 (3405-02)	213427	1580557
	P3 (3405-12)	213508	1580545
	*P2Battery (3307-01)	213345	1580727
	*central pump that draws water from wells 3307-01 to -14		

Confirmed:

C contaminants detected above health based level or MCL at wellhead of public water supply wells.

High:

C chemicals detected below health based level or MCL at wellhead of public water supply wells;

C chemicals above health based levels or MCLs in monitoring wells (where they exist) within WHPA and;

C sources of the chemicals in groundwater have been confirmed in the subsurface within the wellfield's WHPA.

Moderate:

C chemicals detected below health based level or MCL at wellhead of public water supply wells;

C chemicals above health based levels or MCLs in monitoring wells (where they exist) within WHPA and;

C potential sources of the chemicals in groundwater have been identified within WHPA; however, no sources have been confirmed that can be attributed to the chemicals found in the groundwater.

Low:

C no contaminants detected at public water supply or monitoring wells and;

C no potential sources of groundwater contamination have been identified within the WHPA.

The methodology developed in this study provided a significant step in identifying wellhead protection areas and



assessing their vulnerability to surrounding contaminant sources. He cautioned that the methodology had disadvantages as the groundwater flow model used cannot adequately represent complex hydrogeologic areas such as those in Hawaii and the model output and land use analyses should be refined as more information is available.

A wellhead workgroup called the HWHPP Central Oahu Steering Committee has been formed in 1996 and have initiated efforts to compile data on land use activities. The committee, with cross representation from various businesses, county, state, and federal agencies, and community members, have shown an interest in information sharing concerning new hydrogeological data, GIS, land use activities, and best management practices. Currently the committee is in hiatus because of the development of the Hawaii Source Water Assessment Program.

The summary of findings from the assessments of the Central Oahu study will be discussed in more detail in Chapters 4-3 Summary of Groundwater Contamination and 5-4 Summary of Groundwater Quality.

The DOH Maui Wellhead Vulnerability Report

In 1997, DOH had utilized Matthew Hagemann's services to perform a wellhead and vulnerability study for the island of Maui.⁶ WHPAs were identified in west Maui, including the Lahaina area; central Maui, including the communities of Wailuku and Kahului and; east Maui in the vicinity of Haiku. Map 5.4 shows the locations of the WHPAs in the Maui region and Table 5.F lists the wells, their USGS number and coordinates as they are located in their respective aquifer sectors and systems. These areas were chosen because:

- Ⓒ the water from the wells in these areas represents 90% of the daily pumpage for Maui;
- Ⓒ contamination of these wells indicates gross vulnerability of the groundwater, where eight wells in these areas indicated chemical contaminants and;
- Ⓒ sufficient hydrogeologic data was available to model these areas.

The Central Oahu methodology was used for the Maui study. For the WHPA delineations, Hagemann used the WHPA 2.0 model for drinking water wells in the project area and applied two criteria:

- Ⓒ a ten year time of travel to delineate maximum WHPA extent; and
- Ⓒ the identification of a hydrogeologic barrier of the



upgradient flow boundary caused by an identified subsurface barrier such as a dike.

The multiple well capture (MWCAP) module was used and model output was applied to GIS data to provide spatial characterization of WHPAs, drinking water wells, and geographic features.

To assess the vulnerability of the WHPAs to contaminants, GIS was applied to combine map coverages of the WHPAs, and land use and contamination data comprising of USGS land use data, water quality maps, and waste sites. As data coverages were layered they assessed the vulnerability of each WHPA with information on reported incidences of contamination and identified and potential sources of contamination.

The ranking scheme for the vulnerability assessment followed the Oahu study where classifications of confirmed, high, moderate, and low were used. The contamination concerns for Maui was different in that most of the contamination sources are attributed to sugar and pineapple production and Maui does not have the hazardous sites like those found in Central Oahu.

The Maui County Board of Water Supply had expressed interest in developing their own wellhead/source water protection program. They intended to apply the wellhead vulnerability methodology to other areas that are critical for the county. The status of Maui's program has not been reported to DOH.

The summary of findings from the assessments of the Central Oahu study will be discussed in more detail in Chapters 4-3 Summary of Groundwater Contamination and 5-4 Summary of Groundwater Quality. **Insert Map 5.4**


Table 5.F Description of Maui Wells and Locational Data

Aquifer Sector/System	Wells	Latitude	Longitude
Lahaina/Honolua	Kapalua 1 (5938-02)	205913	1563825
	Kapalua 2 (5938-03)	205918	1563801
	Honokohau A (5838-03)	205854	1563833
	Honokohau B (5938-01)	205901	1563825
	Napili A (5838-01)	205837	1562846
	Napili B (5838-02)	205839	1563831
	Napili C (5838-04)	205848	1563836
Lahaina/Honokowai	Kaanapali P1 (5539-01)	205548	1563930
	Kaanapali P2 (5539-02)	205558	1563921
	Kaanapali P4 (5739-01)	205705	1563908
	Kaanapali P5 (5738-01)	205724	1563859
	Kaanapali P6 (5739-02)	205735	1563902
	Hahakea 2 (5540-03)	205503	1564018
Lahaina/Launiupoko	Wahikuli 1 (5439-01)	205420	1563923
	Wahikuli 2 (5439-02)	205427	1563923
	Kanaha 1 (5339-03)	205344	1563930
	Kanaha 2 (5339-04)	205341	1563923
	Waipuka 1 (5339-01)	205320	1563945
	Waipuka 2 (5339-02)	205321	1563945
Wailuku/Iao	North Waihee 1 (5631-02)	205651	1563132
	North Waihee 2 (5631-03)	205651	1563130
	Waihee 1 (5431-02)	205440	1563102
	Waihee 2 (5431-03)	205440	1563101
	Waihee 3 (5431-04)	205444	1563104
	Waiehu Hts. A (5430-01)	205430	1563044
	Waiehu Hts. B (5430-02)	205432	1563044
	Mokuhau 1 (5330-09)	205329	1563055
	Mokuhau 2 (5330-10)	205329	1563055
	Mokuhau 3 (5330-11)	205330	1563054
	Wailuku Shaft (5330-05)	205305	1563043



Aquifer Sector/System	Wells	Latitude	Longitude
Central/Kahului	Reynolds Foods 1 (5129-01)	205159	1562907
	Reynolds Foods 2 (5129-07)	205208	1562848
Central/Paia&Makawao	Hamakuapoko 1 (5420-02)	205425	1562008
	Hamakuapoko 2 (5420-01)	205458	1562054
	Haiku (5419-01)	205410	1561940

Chapter 4-1

Overview of Groundwater Contamination Sources and Groundwater Quality

Hawaii is dependent upon groundwater as over 90% of drinking water sources statewide comes from groundwater supplies. In fact, since the promulgation of EPA's Surface Water Treatment Rule, the State is even more dependent upon groundwater than ever before. Several new groundwater sources have replaced surface water sources in the past several years and this situation will continue in subsequent years. In addition, new groundwater sources have been developed to support the State's growing population.

Groundwater in Hawaii is of high quality as a result of Hawaiian hydrogeology and state and county land and water use policies protecting watershed areas. Any detection of contaminants in drinking water sources prompts increased monitoring, treatment, and enforcement strategies. But land use activities surrounding or near drinking water sources are potential sources of contamination that affect groundwater sources down gradient from watersheds and upland recharge areas.

The major sources of contamination affecting our groundwater have been attributed to sugar, pineapple, and military/industrial activities. As state land uses change from reductions in these activities, potential contamination sources from increased diversified agricultural and industrial activities and residential developments pose new concerns. In addition, growth pressures have placed many potentially contaminating activities such as landfills, many service stations, and waste water disposal facilities closer to water resource areas.



Groundwater Contamination Problems

Another groundwater contamination issue is the residual contamination from Superfund sites. For example, the groundwater around the Del Monte Kunia Superfund Remediation site and U.S.Army Schofield Barracks still shows concentrations of the contaminants that prompted investigations in the 1980s. The removal of the contaminants from the aquifers have not been effectively addressed in remediation requirements that the State has had to comply with.

This section will provide overviews in two areas:

- Ⓒ Description of major groundwater contamination problems; and
- Ⓒ Description of the overall quality of the state's groundwater

This section describes contamination sources and primary contaminants of concern that are of priority to DOH, as shown on Table 5-1. The methodology to determine priority sources utilized peer discussion, data review, and best professional judgement.

Agricultural chemical facilities

Pesticides applications have been a major drinking water concern as extensive applications from previous sugar and pineapple activities, and termiticide applications in residential areas have affected groundwater quality. Ethylene Dibromide (EDB), 1,2-Dibromo-3-Chloropropane (DBCP), 1,2,3-Trichloropropane (TCP), Atrazine, and Chlordane/Dieldrine are the primary contaminants that have been attributed to pesticide use.

Ⓒ EDB, DBCP, and TCP have been monitored since the early 1980's. The levels of these contaminants have stabilized in some wells and appear to be on the rise in other sources, such as newer wells in Central Oahu, East and West Maui. The detection of these contaminants has caused the construction of several granular activated carbon treatment (GAC) units and have prompted the planning and construction of additional GACs.

Ⓒ Atrazine, its breakdown products, simazine, and hexazinone have been locally associated with sugar cane cultivation and nationally associated with corn production. Groundwater sources contaminated with these chemicals appear primarily on the Hamakua Coast of the island of



Hawaii where cane was heavily cultivated. Atrazine also appears on the islands of Oahu, Kauai and Maui. Historically, atrazine levels have exceeded the drinking water MCL in only one drinking water source. Steps to restrict atrazine applications near the drinking water source have resulted in a substantial drop in atrazine levels from 4.3 ppb to <1 ppb.

C Starting in 1995, trace levels of the termiticide dieldrin were found in seven groundwater sources and chlordane in one groundwater source in the State. Statewide surveillance for dieldrin and chlordane showed contamination in drinking water sources located in the primary urban areas in Honolulu and traces have been found in adjacent residential areas in Aiea and Pearl City. Unlike other pesticide contamination occurring in agricultural and former agricultural areas, dieldrin and chlordane are urban based.

Fertilizer applications are a major concern because fertilizers are not regulated and use patterns by inexperienced growers lead to contamination. The increase in nitrates is a potential problem because of the extent of its application, its proximity to drinking water sources, the unregulated volume that is applied, and the concentration of application. Excessive nitrate levels found in Kunia, Oahu are attributed to fertilizer applications.

On-farm agricultural mixing and loading procedures is another concern as previous mixing and loading mishaps have led to pesticide contamination in the Kunia area which resulted in a Superfund Remediation Project around the spill site. The source of the EDB contamination found in the drinking water well in service at the time was believed to be a storage/handling facility located in the Del Monte Corporation's Kunia Village close to the well. These activities are threatening because of the human health and environmental risks, the size of population affected, relative location of applications, the extent that it is and has been used, and the documented occurrences in highly vulnerable and sensitive areas.

Storage and Treatment Activities

Underground storage tanks (UST) and leaking underground storage tanks (LUST) are of concern as nearly 8000 sites have been registered and nearly 1200 have reported releases. Although no detections of contaminant levels have been

found in drinking water sources attributable to USTs, the number, proximity, and duration of leaks from these tanks are potential sources of groundwater contamination. The release of petroleum products pose acute and chronic health and environmental risks to people and groundwater resources.

Disposal Activities

Landfills pose the threat of leaching harmful waste materials into the subsurface and groundwater. State regulations have imposed design and operating standards that include site locations away from drinking water sources, but contrarily, wells may be sited near facilities such as landfills. This situation will increase groundwater problems as growth pressures increase the demand for potable water.

Injection wells are a concern because of their widespread use and nature of discharging wastewater directly into the subsurface or aquifers. Currently there are over 500 underground injection wells utilized for wastewater from activities such as sewage, industrial activities, aquaculture, and geothermal activities; and there are over 2000 drywells used for stormwater runoff.

C Related to injection wells, and not listed on Table 5-1, are drainage wells. They pose a continued potential risk to groundwater as uncharacterized wastes from roadways, pavement areas, and illegal dumping are discarded into the subsurface.

Table 5-1. Major Sources of Ground Water Contamination

Contamination Source	Ten Highest-Priority Sources (T)	Factors Considered in Selecting a Contaminant Source (1)	Contaminants (2)
<i>Agricultural chemical facilities</i>			
Animal feedlots			
Drainage wells			
Fertilizer applications	T	C, D, E, F, H	E
Pesticide applications	T	A, B, C, D, E, F, H	A, B, C
On-farm agricultural mixing and loading procedures	T	A, C, E, F, B, D	B
<i>Storage and Treatment Activities</i>			
Land application (regulated or permitted)			
Material stockpiles			
Storage tanks (above ground)			



Contamination Source	Ten Highest-Priority Sources (T)	Factors Considered in Selecting a Contaminant Source (1)	Contaminants (2)
Storage tanks (underground)	T	D, H, C, E, A	D
Surface impoundments			
Waste piles			
Waste tailings			
<i>Disposal Activities</i>			
Deep injection wells			
Landfills	T	A, D, E, F	
Septic systems			
Shallow injection wells	T	D, E, F, H	
<i>Other</i>			
Hazardous waste generators			
Hazardous waste sites			
Large industrial facilities	T	A, B, D, H	C, D, H
Material transfer operations			
Mining and mine drainage			
Pipelines and sewer lines	T	A, C, E, G, H	D
Salt storage and road icing			
Salt water intrusion	T	B, C, E	G
Spills	T	A, B, C, G, H	A, B, C, D
Transportation of materials			
Urban runoff			
Small-scale manufacturing and repair shops			
Other sources:			

Table 5-1. Major Sources of Ground Water Contamination Factor Symbols

1. Factors Considered in Selecting a Contaminant Source
 - A. Human health and/or environmental risk (toxicity)
 - B. Size of the population at risk
 - C. Location of the sources relative to drinking water sources
 - D. Number and/or size of contaminant sources
 - E. Hydrogeologic sensitivity
 - F. State findings, other findings
 - G. Documented from mandatory reporting
 - H. Geographic distribution/occurrence
 - I. Other criteria (please add or describe in the narrative)
2. Contaminants
 - A. Inorganic pesticides
 - B. Organic pesticides
 - C. Halogenated solvents
 - D. Petroleum solvents
 - E. Nitrate
 - F. Fluoride
 - G. Salinity/brine
 - H. Metals
 - I. Radionuclides
 - J. Bacteria
 - K. Protozoa
 - L. Viruses
 - M. Other (please add or describe in the narrative)



Other Concerns

Large industrial facilities are not extensive in Hawaii, but industrial activities principally from military facilities have resulted in three of the four National Priorities Site listings in Hawaii. These sites are located on the island of Oahu and include the U.S. Navy Pearl Harbor Naval Facility and Naval Computer and Telecommunications Area Master Station Eastern Pacific, and the U.S. Army Schofield Barracks. The primary contaminants from these activities are Trichloroethylene (TCE) and Tetrachloroethylene (PCE).

Ⓒ TCE was first detected by the U.S. Army in 1985 at levels as high as approximately 45 ppb, and had been added to the list of regulated contaminants for drinking water in 1987 and is monitored regularly as a volatile organic chemical. TCE has been the subject of the Schofield Barracks Remediation Investigation. Many sites on base were investigated, and the exact source of the contamination have not been identified. This phase of the work has been terminated.

Ⓒ PCE had been traced to a number of chemicals used at laundry activities at Pearl Harbor where substantial groundwater contamination have been attributed to solvent chemicals.

Groundwater contamination from volatile organic chemicals, solvents, petroleum compounds, and metals are concerns because of the potential toxic releases that may directly affect people or the environment.

Pipelines that transport petroleum products are a concern because:

1. They have the potential to leak substantial quantities of contaminants into the subsurface and into aquifers;
2. The underground nature of pipelines make detection of leaks extremely difficult; and
3. These pipelines transverse substantial distances over valuable groundwater resources.

Sewer lines pose a similar risk, but the waste material involved is generally less persistently toxic.

Salt water intrusion is an existing problem brought on by over pumping and a diminishing fresh water lens. The upconing of salt water will increase as pumping demand increases in areas where the sustainable yield of aquifers have been reached. This problem is critical in island environments where groundwater supplies are localized.

Chemical spills are a drinking water concern especially after the Del Monte spill in Kunia and other spills in the Schofield



Overall Quality of the State's Groundwater

area. Another concern is the aggregate affect of spills or ill advised disposal of household hazardous materials.

The State has been involved in tracking groundwater quality through DOH Groundwater Contamination Maps for the State of Hawaii. The intent of the maps is to identify wells with detectable levels of groundwater contamination. The contamination levels that are reported, refer to approximate levels of contamination that are valid for a specific sampling date. Levels of groundwater contamination may fluctuate for a number of reasons, including actual diminishing or increasing levels of contamination, chemical breakdown of contaminants, variances in sampling and analytical methods, the effects of pumping rates, and other factors. (Refer to Appendix K for a copy of the 1997 report)

The 1997 report consists of maps and tables for the islands of Kauai, Oahu, Maui, Molokai, Lanai, and Hawaii. Maps identify the locations of contaminated wells and wellfields (an area where many wells in close proximity share the same groundwater source). Tables relate information about the contaminated well, such as the use of the well (e.g., drinking water, irrigation, industrial or unused), the contaminant detected, the concentration of the contaminant (e.g., detected level), the sampling date when contamination was detected, and drinking water standards and health risks associated with each contaminant. In cases where wellfields are identified, the well or pump in that wellfield with the highest concentration of a contaminant is reported.

A contaminant which has been identified in prior editions will be removed from the report if subsequent monitoring shows no detection. A well will be removed from the map if it does not show any detectable concentrations of contamination. But a well and associated contaminant(s) will remain on the map until new information can confirm that concentrations have decreased to non-detectable levels. This is the case with several irrigation wells in this report that were on previous editions where the lack of data prevents any updates of their status.

In general, the concentration of chemical contaminants found in our wells have been detected at levels below State and Federal drinking water standards. Drinking water wells with detected contaminant concentrations that are increasing are closely monitored. If contamination levels approach State



and Federal drinking water regulatory limits, water is then treated to reduce the concentration to safe levels, or the well will be temporarily or permanently taken out of service.

New information on contamination from Atrazine, a regulated herbicide used statewide is provided. In their study on pesticide use, DOA had monitored selected wells on Kauai and Maui in areas where Atrazine has been applied extensively. DOA had used the Enzyme Linked Immunosorbent Assay (ELISA) analysis method to detect concentrations of this contaminant.

The following is a listing of the contaminants that have been detected in groundwater supplies. (Refer to the pages on Applicable Drinking Water Standards for definitions of the acronyms.)

TABLE H: GROUNDWATER CONTAMINANTS

Island	Primary Contaminants
Oahu	Alachlor, Ametryn, Atrazine, Desethyl Atrazine, Despropyl Atrazine, Diamino Atrazine, Chlordane, Dieldrin, DBCP, DCP, EDB, PCE, TCE, and TCP
Maui	Ametryn, Atrazine, Desethyl Atrazine, Despropyl Atrazine, Diamino Atrazine, Diuron, DBCP, EDB, Simazine, and TCP
Hawaii	Atrazine, Desethyl Atrazine, Despropyl Atrazine, Diamino Atrazine, Hexazinone, and Simazine
Kauai	Ametryn, Atrazine, Desethyl Atrazine, and Simazine

Molokai and Lanai did not have any reported SOC and VOC contaminants.

Since the 1996 edition, the following wells were removed from these maps because contaminant concentrations were not detected: Napili B and C wells on Maui, and the Kilohana I well on Kauai. The following wells were added because of new detection of contaminants: Halawa Wells Pump II on Oahu, Ookala Well on Hawaii, and Paua Valley 2 well on Kauai.



Chapter 4-2

Overview of Groundwater Protection Programs

Hawaii has generally taken good advantage of its hydrology to protect vital drinking water resources. Generally, water is collected in the interior mountain regions of the islands and moves both overland and underground toward the ocean. Watershed areas in the extreme interiors of each island are preserved through conservation district classifications in State land use regulations and preservation zoning in respective county land use policies.

The State has been involved with groundwater protection through studies, data compilation and management, regulations, and initiatives and Table 5-2 describes the groundwater protection activities and programs in these areas. Attachment 5-2.1 provides additional information on county, state, and federal programs that are involved in source water protection and protection-related programs.

Groundwater studies

Aquifer classification, mapping, characterization, and vulnerability assessment studies of DOH that have been described in detail in Chapter 4. Aquifer sectors, systems, and types have been identified statewide with characterizations of its sensitivity and vulnerability.

C DLNR have established another set of hydrologic units that are used as aquifer boundaries in the water use and well permit approvals by the State Commission on Water Resource Management (CWRM)

Vulnerability assessments in wellhead studies are described in Chapter 4. Wellhead protection areas on Oahu and Maui have been identified, and discussed in more detail in Chapters 4-3 and 5-4 of this report.

Data compilation and management

An ambient groundwater monitoring system is under development by DOH and is under the direction of the Safe Drinking Water Branch.

A comprehensive data management system is under development by DOH and is under the direction of the



Environmental Planning Office.

The State Source Water Assessment Program (SWAP) is being developed by DOH through the SDWB. SWAP should be developed by 1999 and fully implemented by 2003.

Groundwater regulations

Federal SARA and RCRA superfund programs have been established and are under the direction of DOH.

☺ The Office Hazard Evaluation and Emergency Response has fully established an active SARA Title III Program, and responds to hazardous substances and oil in the environment, releases of hazardous substances, and investigates contaminated and potentially contaminated sites in the State. .

☺ The Hazardous Waste Program, in the Solid and Hazardous Waste Branch, regulates all generators, transporters, and owner/operators of treatment, storage and disposal facilities. The program has established a State RCRA program and is involved in waste minimization efforts and activities.

State Management Plan for Pesticides is under development by DOA-Pesticides Branch.

State septic tank regulations have been fully established by DOH and are under the direction of the Wastewater Branch.

Underground storage tank installation requirements have been fully established by DOH and are under the direction of the Underground Storage Tank and Leaking Underground Storage Program.

Underground storage tank permit program is under development in the Underground Storage Tank and Leaking Underground Storage Program.

Underground injection control (UIC) program is fully established by DOH. (State program only, the State is pursuing federal delegation.)

- The UIC program has identified areas of existing and potential sources of drinking water and established a boundary around these areas. The UIC line, which separates these areas from areas in which underground injection is allowed, generally preserves the interior areas of all islands.



Groundwater Protection Initiatives

Well installation and well abandonment regulations are fully established by DLNR and are under the direction of CWRM.

EPA-endorsed Core Comprehensive State Groundwater Protection Program is under revision by DOH and is under the direction of the SDWB.

Groundwater Best Management Practices (BMPs) is pending development by DOH. The PRCP and the State Coastal Zone Management Program has developed BMPs for non-point source polluting activities affecting surface waters. The GWPP is in the process of compiling similar measures related to groundwater.

Groundwater legislation is a continuing effort by DOH in areas of drinking water protection issues and policies.

Interagency coordination for groundwater protection initiatives is under development by DOH. PRPC has coordinated with federal, state, and county agencies in the areas of erosion control, sedimentation issues, and BMPs preventing non-point source pollution. GWPP/SDWB is in the process of coordinating with federal, state, and county agencies on groundwater and drinking water protection issues with efforts like SWAP and the Hawaii Water Quality Plan

Non-point source controls are continuing efforts of DOH through PRCP.

Pollution prevention efforts are pending establishment by DOH. Initial efforts have been implemented by OSMW, CWB, and EPO.

The Hawaii Wellhead Protection Program (HWHPP) was approved by EPA in 1995. HWHPP has been involved with wellhead vulnerability studies for areas on the islands of Oahu and Maui, and community activities on the island of Molokai.

Table 5-2. Summary of State Ground Water Protection Programs

Programs or Activities	Check (T)	Implementation Status	Responsible State Agency
Active SARA Title III Program	T	fully established	DOH-HEER
Ambient ground water monitoring system	T	under development	DOH-SDWB
Aquifer vulnerability assessment	T	fully established	DOH-SDWB-GWPP/ DLNR-CWRM



Programs or Activities	Check (T)	Implementation Status	Responsible State Agency
Aquifer mapping	T	fully established	DOH-SDWB-GWPP/ DLNR-CWRM
Aquifer characterization	T	fully established	DOH-SDWB-GWPP/ DLNR-CWRM
Comprehensive data management system	T	under development	DOH-EPO
EPA-endorsed Core Comprehensive State Ground Water Protection Program	T	under revision	DOH-SDWB-GWPP
Ground water discharge permits			
Ground water Best Management Practices	T	pending	DOH-SDWB-GWPP -CWB-PRCP
Ground water legislation	T	continuing efforts	DOH/DLNR
Ground water classification	T	continuing efforts	DOH-SDWB-GWPP DLNR-CWRM
Ground water quality standards			
Interagency coordination for ground water protection initiatives	T	under development	DOH/DLNR/DOA
Nonpoint source controls	T	continuing efforts	DOH-CWB-PRCP
Pesticide State Management Plan	T	under development	DOA-PB
Pollution Prevention Program	T	pending	DOH-OSWM-CWB-EPO
Resource Conservation and Recovery Act (RCRA)			
Source Water Assessment Program	T	under development	DOH-SDWB
State Superfund	T	fully established	DOH-HEER
State RCRA Program incorporating more stringent requirements than RCRA Primacy	T	fully established	DOH-SHWB
State septic system regulations	T	fully established	DOH-WWB
Underground storage tank installation requirements	T	fully established	DOH-SHWB
Underground Storage Tank Remediation Fund			
Underground Storage Tank Permit Program	T	under development	DOH-SHWB
Underground Injection Control Program	T	fully established	DOH-SDWB-UICP
Vulnerability assessment for drinking water/wellhead protection	T	under development	DOH-SDWB-GWPP
Well abandonment regulations	T	fully established	DLNR-CWRM
Wellhead Protection Program (EPA-approved)	T	continuing efforts	DOH-SDWB-GWPP
Well installation regulations	T	fully established	DLNR-CWRM
Other programs or activities (please specify)			

Table 5-2. Summary of State Ground Water Protection Programs:
List of acronyms

DOA	Hawaii Department of Agriculture
DOH	Hawaii Department of Health
DLNR	Hawaii Department of Land and Natural Resources
CWB	Clean Water Branch
CWRM	Commission on Water Resource Management
EPO	Environmental Planning Office
GWPP	Groundwater Protection Program
HEER	Office of Hazard Evaluation and Emergency Response
OSWM	Office of Solid Waste Management
PB	Pesticides Branch
PRCP	Polluted Runoff Control Program



SDWB	Safe Drinking Water Branch
SHWB	Solid and Hazardous Waste Branch
UICP	Underground Injection Control Program
WWB	Waste Water Branch



Attachment 5-2.1

List of Source Water Protection and Protection-related Programs (March 1998)

The following list, in alphabetical order, refers to federal, state, and county programs that are involved in different degrees with source water protection, both surface and groundwater resources. This list attempts to be comprehensive but may not be complete. The term “intensity” generally describes the ability and level of activity of a program to implement protective actions. The scale used for intensity is high, moderate, low, and potential.

Ⓒ High: Full-time work that directly focuses on source or groundwater protection.

Ⓒ Moderate: Part-time work that directly focuses on the same.

Ⓒ Low: Infrequent work.

Ⓒ Potential: High ability but low activity, with the possibility of elevating the level of activity.

Source Water Protection Programs

Name: **Conservation District Use**

Authority: HRS Chapter 183-41; HAR, Title 13, Chapter 2. Regulates by permit.

Agency: Land Management Division, DLNR

Purpose: The Conservation District Use Permit review approves or disapproves activities in special, protective, resource, general, and limited subzones.

Intensity: Moderate to low

Name: **Drinking Water Program**

Authority: HRS Chapter 340E; HAR, Title 11, Chapter 20. Regulates by approvals and certification. Can enforce by order and penalty.

Agency: Safe Drinking Water Branch, DOH

Purpose: Regulates all public water systems defined as serving \$ 25 persons for 60 days per year or has at least 15 service connections. Regulatory activities include sampling and monitoring, water treatment operator certification, and compliance enforcement.

Intensity: Low

Name: **Hawaii Wellhead Protection Program**

Authority: The Safe Drinking Water Act Amendments of 1986, Section 1428. Non regulatory.

Agency: Safe Drinking Water Branch, Department of Health (DOH)

Purpose: Initiates county- and community-based wellhead protection programs that involve technical studies, data collection, field surveys, establishment of voluntary protection measures, and public education and outreach.

Intensity: Potential

Name: **Hazardous Waste Program**

Authority: HRS 342 J; HAR, Title 11, Chapters 260 to 280. Regulates by permit, closure, and corrective action.

Agency: Solid and Hazardous Waste Program, DOH

Purpose: Regulates all generators, transporters, and owner/operators of treatment, storage and



disposal facilities. The program is involved in waste minimization efforts and activities.

Intensity: Moderate to low

Name: **Hazard Evaluation and Emergency Response**

Authority: HRS Chapters 128D and 128E; HAR, Title 11, Chapter 451. Regulates through investigations.

Agency: Office of Hazard Evaluation and Emergency Response, DOH

Purpose: Responds to hazardous substances and oil in the environment, releases of hazardous substances, and investigates contaminated and potentially contaminated sites in the State. HEER staff work with county, state, and federal agencies regarding Hawaii's Emergency and Contingency Plans.

Intensity: Moderate to low

Name: **National Pollutant Discharge Elimination System (NPDES) Permit Program**

Authority: HRS Chapter 342; HAR, Title 11, Chapter 55. Regulates by permit and can enforce by order and penalty.

Agency: Clean Water Branch, DOH

Purpose: Regulates all point source discharges of wastewater and storm water from municipal, industrial and federal systems and facilities into State waters.

Intensity: Low

Name: **Pesticides management and control**

Authority: HRS Chapter 149A; HAR, Title 4, Chapter 66. Regulates by certification and restrictions.

Agency: Pesticides Branch, Department of Agriculture

Purpose: DOA is responsible for the regulation management of pesticide use in the State and may initiate regulatory actions such as use restrictions, cancellation or registration denial, and to limit applications to areas or times necessary to protect groundwater. DOA also has an extension service that educates certified applicators on the proper use and storage of pesticides.

Intensity: Moderate

Name: **Polluted Runoff Control Program**

Authority: HRS 342E; Clean Water Act Section 6217. Non regulatory.

Agency: Clean Water Branch, DOH

Purpose: Initiates non-point source activities and coordinates with county, state, federal agencies, and business, community, and non-profit organizations. Activities include erosion control, watershed protection, and establishment of best management practices for business and agencies.

Intensity: Low

Name: **Solid Waste Management**

Authority: HRS 340A and 342G; HAR, Title 11, Chapter 58. Regulates by permit, and can enforce by order and penalty.

Agency: Office of Solid Waste Management, Solid and Hazardous Waste Branch, DOH

Purpose: Regulates all municipal solid waste landfills, solid waste incinerators, transfer



stations, and regulates the disposal of used motor oil, lead acid batteries, scrap materials, and medical wastes. The office is involved with recycling programs and public education activities, and investigates illegal dumpings and complaints.

Intensity: Moderate to low

Name: **Source Water Protection Program (still in development)**

Authority: Safe Drinking Water Act Amendments of 1996, Sections 1428 and 1453. Non-regulatory.

Agency: Safe Drinking Water Branch, DOH

Purpose: The Source Water Protection Program will serve as the umbrella entity for protection programs such as the Hawaii Wellhead Protection Program. The program will incorporate technical studies, data collection, field surveys, public education and outreach, and interagency coordination to develop protective measures for public water sources.

Intensity: Potential

Name: **State Water Code**

Authority: HRS Chapter 174C; HAR, Chapters 167 to 171. Regulates by permit, designation of management areas, and penalties. Can enforce by order and penalty.

Agency: Commission on Water Resource Management, Department of Land and Natural Resources (DLNR).

Purpose: The Commission enforces the State Water Code that regulates all uses of Hawaii's water resources. Responsibilities include issuance of permits for water use, well construction, pump installation, stream channel alteration, and stream diversion works. The Commission also enforces the water code through dispute resolution and citizen complaints.

Intensity: High

Name: **Underground Injection Control (UIC) Program**

Authority: HRS 340E; HAR, Title 11, Chapter 23. Regulates by permit and can enforce by order and penalty.

Agency: Safe Drinking Water Branch, DOH

Purpose: Regulates all injection well activities to protect underground sources of drinking water from contamination from subsurface, injection well discharges of various types of wastewater.

Intensity: High

Name: **Underground Storage Tank/Leaking Underground Storage Tank (LUST) Program**

Authority: HRS Chapter 342L; RCRA Subtitle 1, Regulates by permit, and clean-up/remediation requirements, and penalties.

Agency: Solid and Hazardous Waste Branch, DOH

Purpose: Regulates the siting and installation of underground storage tanks containing petroleum and petroleum-based products. LUST program investigates and oversee LUST clean-up and remediations by responsible parties, and has established a trust fund to handle emergency clean-up of abandoned sites.

Intensity: Moderate



Name: **Wastewater Systems**

Authority: HAR, Title 11, Chapter 62. Regulates by approvals and penalty.

Agency: Wastewater Branch, DOH

Purpose: Regulates all wastewater facilities including sewage treatment plants, septic systems, and allowable cesspools. The branch provides guidance in effluent reuse and confined animal feeding activities.

Intensity: Moderate

Protection-related Programs

Name: **State land use and zoning**

Authority: HRS Chapter 205; HAR, Title 15, Chapter 15. Regulates by amendment approvals.

Agency: State Land Use Commission, Department of Business, Economic Development, and Tourism (DBEDT)

Purpose: LUC regulates the statewide zoning system with established land uses in Urban, Agricultural, Rural, and Conservation districts. LUC decides upon any amendments to redistrict state land use districts. LUC regulates land use activities in agricultural and conservation districts, and counties regulate urban and rural areas under 15 acres.

Intensity: Moderate to low

Name: **State land use boundary review**

Authority: HRS, Chapter 226. Regulates by amendment reviews.

Agency: Office of Planning (DBEDT)

Purpose: The Planning Office represents the State in LUC amendment petitions. The office conducts research and public hearings on land use boundary reviews and changes.

Intensity: Moderate to low

Name: **Resource Conservation Service**

Authority: (Insert here) Regulates through conservation plans.

Agency: Natural Resource Conservation Service (NRCS), United States Department of Agriculture

Purpose: NRCS provides technical assistance to agricultural activities in areas of production and cultivation practices, and economic management of activities. Conservation plans provide proper production methods and the use of best management practices to minimize adverse environmental impacts.

Intensity: Moderate to low

Name: **County planning and land utilization**

Authority: HRS, Chapter 205; respective County Charters. Regulates through zoning approvals and penalties.

Agency: County Planning and Land Utilization Departments

Purpose: The county planning and land utilization entities regulate specific land uses in each county. They implement respective zoning and land use laws affecting all urban and rural areas as well as some agricultural state land use districts. The LUC decides upon land use changes of 15 acres or more.

Intensity: Moderate to low



Chapter 4-3

Summary of Groundwater Contamination Sources

The DOH wellhead vulnerability studies recognized significant sources of contamination in the Central Oahu region and in west, central, and east Maui areas. In Central Oahu, sugar and pineapple production, leaking underground storage tanks, and military facilities constitute the major sources of groundwater contamination. On Maui, the majority of significant contamination sources were from sugar and pineapple production with some impacts from waste sites. This section describes the significant contaminant sources that were recognized in the wellhead vulnerability studies for Central Oahu and Maui.

The vulnerability ranking scheme that was applied for both studies consisted of four classifications:

- C confirmed;
- C high;
- C moderate; and
- C low.

These ranking classifications will be used in describing the vulnerability of the specific wellhead protection area and aquifer system to groundwater contamination. Refer to Chapter 4 Groundwater Assessment for detailed descriptions of these classifications.

Central Oahu

The 1995 Central Oahu study had ranked the wellhead protection areas (WHPA) I and III with confirmed vulnerability. (See Map 5-3.1) In these areas, chemicals from three recognized contaminated areas, numerous leaking underground storage tanks, and agricultural land uses have contributed to degradation of water quality to levels in excess of drinking water standards. In WHPAs II and IV vulnerability was ranked as moderate because no point sources of contamination have not been identified in the subsurface, and any detections of chemicals were below state drinking water standards. The following will provide more detail of contamination sources as they relate to the WHPAs they reside in and for respective aquifers systems. Refer to Table 5.E for a listing of the wells and the WHPAs, aquifer sectors and systems they reside in.

WHPA I: Pearl Harbor Aquifer Sector/Kunia & Waipahu &



Waiawa Aquifer Systems

WHPA I was ranked with confirmed vulnerability. Table 5-3.a shows that the major sources of contamination to the aquifer are attributed to the NPL or Superfund site on Del Monte's Oahu Plantation, DOD U.S. Air Force fuel storage facilities, several reported releases of leaking underground storage tanks, and previous sugar and pineapple production activities in the aquifer region. See Map 5-3.2 for the location of these sites. The following provides more detail about these contamination sources.


Table 5.E Description of Central Oahu Wells and Locational Data

Wellhead Protection Area (WHPA) Aquifer Sector/System	Wells			Latitude	Longitude	
WHPA I Pearl Harbor/ Kunia & Waipahu & Waiawa	Mililani I:	P1	(2800-01)	212803	1580007	
		P2	(2800-02)	212803	1580007	
		P3	(2800-03)	212803	1580007	
		P4	(2800-04)	212803	1580007	
	Mililani II:	P1	(2859-01)	212829	1575933	
		P2	(2859-02)	212830	1575933	
	Mililani III:	#1	(2600-03)	212659	1580044	
		#2	(2600-04)	212659	1580042	
	Waipio Hts:	#1	(2459-20)	212428	1575953	
		#2	(2459-19)	212427	1575952	
	Waipio Hts I:	#3	(2459-23)	212426	1575952	
		#4	(2459-24)	212425	1575952	
	Waipio Hts II:	#1	(2500-01)	212522	1580030	
		#2	(2500-02)	212522	1580030	
	Waipio Hts III:	#1	(2659-02)	212640	1575953	
		#2	(2659-03)	212639	1575952	
	Waipahu Wells:	P1	(2400-02)	212415	1580026	
		P2	(2400-01)	212415	1580026	
		P3	(2400-03)	212415	1580026	
		P4	(2400-04)	212415	1580026	
	Waipahu II:	#1	(2400-06)	212414	1580053	
		#2	(2400-05)	212414	1580053	
	Hoaeae Well 1:	P1	(2301-34)	212321	1580137	
		P2	(2301-35)	212321	1580137	
		P3	(2301-36)	212321	1580137	
		P4	(2301-37)	212321	1580137	
		P5	(2301-38)	212321	1580137	
		P6	(2301-39)	212321	1580137	
	Dairy Company			(2600-02)	212601	1580041
	Kunia I:	P1	(2303-01)	212318	1580208	
		P2	(2303-02)	212318	1580208	
		P3	(2303-03)	212316	1580205	
		P4	(2303-04)	212316	1580205	
	Kunia II:	P1	(2402-01)	212410	1580231	
		P2	(2402-02)	212408	1580230	
		P3	(2402-03)	212409	1580227	
	Hawaii Country Club			(2603-01)	212618	1580338



Wellhead Protection Area (WHPA) Aquifer Sector/System	Wells	Latitude	Longitude
WHPA II & III Central/Wahiawa	Del Monte Pump 3 (2803-05)	212838	1580327
	Wahiawa Wells: P1 (2901-11)	212946	1580141
	P2 (2901-12)	212945	1580142
	P3 (2901-08)	212944	1580143
	Wahiawa 2 (2902-02)	212948	1580218
	Schofield Battery: (2901-02)	212927	1580148
	(2901-03)	212927	1580148
WHPA IV North/Waialua	(2901-04)	212927	1580148
	(2901-06)	212927	1580148
	(2901-07)	212927	1580148
	(2901-10)	212927	1580148
	Haleiwa 1 (3405-03)	213449	1580542
	Haleiwa 2 (3405-04)	213448	1580543
	Waialua Wells: P1 (3405-01)	213428	1580557
	P2 (3405-02)	213427	1580557
	P3 (3505-12)	213508	1580545
	*P2Battery (3307-01)	213345	1580727
	*central pump that draws water from wells 3307-01 to -14		

Table 5-3.a Ground Water Contamination Summary

Hydrogeologic Setting	Island of Oahu, Central Oahu Wellhead protection Area I: Kunia/Waipahu/Waiawa Aquifer Systems
Spatial Description (optional)	Refer to Map 1, Map 2, Map 3, Map 4
Map Available (optional)	Yes
Data Reporting Period	October 1995

Source Type	Number of sites	Number of sites that are listed and/or have confirmed releases	Number of sites with confirmed ground water contamination	Contaminants	Number of site investigations (optional)	Number of sites that have been stabilized or have had the source removed (optional)	Number of sites with corrective action plans (optional)	Number of sites with active remediation (optional)	Number of sites with cleanup completed (optional)
NPL	1	1	1	DBCP EDB	N/A	N/A	N/A	N/A	N/A
CERCLIS (non-NPL)	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
DOD/DOE	1	1	1	TCE	N/A	N/A	N/A	N/A	N/A
LUST	see below	see below	N/A	see below	N/A	N/A	N/A	N/A	N/A
RCRA Corrective Action	2	2	N/A	Petroleum hydrocarbons	N/A	N/A	N/A	N/A	N/A
Underground Injection	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
State Sites	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
Non-point source	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Other (specify)	Previous sugar and pineapple production	Refer to Table 5-4.a	Refer to Table 5-4.a	DBCP EDB TCP	N/A	N/A	N/A	N/A	N/A

N/A - not available

NPL - National Priority List

CERCLIS (non-NPL) - Comprehensive Environmental Response, Compensation, and Liability Information System

DOE - Department of Energy

DOD - Department of Defense LUST - Leaking Underground Storage Tanks RCRA - Resource Conservation and Recovery Act

Insert Map 5-3.2



The NPL or Superfund site in the area is the Del Monte Corporation's Oahu Plantation occupying 6000 acres near the community of Kunia. The site was placed on the NPL list in December 1994. The groundwater well in the area, Del Monte Kunia well, had detected high concentrations of ethylene dibromide (EDB) and 1,2-dibromo-3-chloropropane (DBCP) since 1980. Investigations found two sources of contamination coming from a storage area that was used from the 1940's to 1975, and an area near the well where 495 gallons of EDB spilled in 1977. In 1980 the well was ordered to be placed out of service, and until 1994 the water was sprinkled on non-crop fields. Other remediation measures were implemented such as removal of 18,000 tons of soil.

The DOD site identified in Table 5-3.a is the United States Air Force Waikakalaua and Kipapa Fuel Storage Annexes (FSAs) and the petroleum, oil, and lubricant (POL) pipeline. The POL pipeline connects the FSAs to Hickam Air Base, a major military facility adjacent to the Honolulu International Airport and Pearl Harbor. The concern with this fuel distribution network were detections of trichloroethylene (TCE) from solvents and petroleum related products.

Two reported releases of underground storage tanks in Del Monte's Oahu Plantation have been referred to the Hazard Evaluation and Emergency Response Program in DOH.

Besides Del Monte's Oahu Plantation, other sugar and pineapple production activities have contributed to groundwater contamination to this portion of the Pearl Harbor aquifer. For decades prior to the 1980s, Central Oahu was predominantly used for agriculture. These activities are attributed to the organic contaminants from pesticides, fumigants, and fertilizers that have been detected in the drinking water wells in the area.

In 1982, DBCP was detected in a Mililani II well. As a precautionary measure, the well was shut down that year and remained closed until 1986 when granular activated carbon (GAC) units were constructed for water treatment.

In 1983, contamination forced the closure of the following wells which required the construction of GAC treatment units : EDB contamination in the Waipahu wells, DBCP in the Kunia II wells, DBCP in the Mililani I wells.

1,2,3-trichloropropane (TCP) was found in nine of ten



wells. TCP is an impurity associated with the nematocide dichloropropene-dichloropropane (DD).

Currently, the detection of contaminants in the drinking water wells in this aquifer are below state and federal drinking water standards. The status of this aquifer will be described in more detail in Chapter 4-4 Summary of Groundwater Quality.

WHPA II and III: Central Sector/Wahiawa Aquifer System

This aquifer region is located in the Wahiawa area of Oahu and encompasses WHPAs II and III. Pineapple production and military activities are the primary land use activities and regarded as the point sources of groundwater contamination in this area. The DOH Central Oahu study had ranked WHPA II, surrounded partially by the U.S. Army Schofield Barracks, with moderate vulnerability to contamination. WHPA III was ranked with confirmed vulnerability, with surrounding activities including Schofield Barracks, the Wheeler Army Air Base, and the U.S. Navy Naval Computer and Telecommunications Area Master Station Eastern Pacific (NCTAMS EASTPAC). As noted on Table 5-3.b, the two superfund sites are Schofield and NCTAMS EASTPAC, DOD Wheeler Army Air Base, and 85 reported releases of leaking underground storage tanks. The following provides more detail on these facilities.

The two NPL sites are Schofield Barracks and the NCTAMS EASTPAC.

Schofield Barracks, an installation of the Army Support Command, Hawaii, was established in 1908 as a base for the Army's mobile defense of Pearl Harbor and the entire island. Industrial operations involve maintenance, repair, painting, and degreasing, all using various forms of organic solvents. In 1985 high concentrations of TCE had been detected in wells supplying drinking water to 25,000 people at Schofield Barracks and also having potential impact to 55,000 people in Wahiawa and Mililani. Since 1986, the Army started operating an air stripping facility to remove TCE. The facility is participating in the Installation Restoration Program. The program, established in 1978, seeks to identify, investigate, and clean up contamination from hazardous materials.

The NCTAMS EASTPAC site is used for operating and maintaining facilities and equipment for the Navy's Defense Communication System. This site consist of



facilities at Wahiawa, Lualualei, Opana, Kolekole Pass, Pearl Harbor, and various satellite communication locations. The Wahiawa facility occupies 700 acres on the central plateau of Oahu. Polychlorinated biphenyls (PCBs) have been detected in soil surrounding electrical transformers near on base residences. In addition, an inactive landfill was used for general disposal of all wastes generated from the site from the 1940s to 1973. Since 1988, the Navy has been conducting soil sampling and in 1990 soil removal activities began and completed in 1991.

Another military facility in this region is the Wheeler Army Air Base. There had been 11 reported releases of leaking underground storage tanks at this installation, and other concerns have been maintenance and servicing operations of military aircraft and vehicles.

Leaking underground storage tanks are another major contamination concern in this aquifer region. In addition to the 11 releases at Wheeler, 68 have been reported at Schofield and 6 have been reported at the NCTAMS EASTPAC installation.

The summary of the groundwater quality in the Wahiawa aquifer system will be described in more detail in Chapter 4-4 of this report.

WHPA IV: North Sector/Waialua Aquifer System

WHPA IV is located in the north portion of Oahu and encompasses agricultural lands used for pineapple and sugar production. As noted in Table 5-3.c, there are no major contaminant sources, such as, leaking underground storage tanks or hazardous waste sites. DOH has concerns of pesticides use associated with sugar and pineapple production. The Central Oahu wellhead vulnerability study had ranked WHPA IV with moderate vulnerability.

The summary of groundwater quality in the Waialua aquifer system will be described in more detail in Chapter 4-4 of this report.

Table 5-3.b Ground Water Contamination Summary

Hydrogeologic Setting
 Spatial Description (optional)
 Map Available (optional)
 Data Reporting Period

Island of Oahu, Central Oahu Wellhead protection Areas II & III: Wahiawa Aquifer System
 Refer to Map 1, Map 2, Map 3, Map 4
 Yes
 October 1995

Source Type	Number of sites	Number of sites that are listed and/or have confirmed releases	Number of sites with confirmed ground water contamination	Contaminants	Number of site investigations (optional)	Number of sites that have been stabilized or have had the source removed (optional)	Number of sites with corrective action plans (optional)	Number of sites with active remediation (optional)	Number of sites with cleanup completed (optional)
NPL	2	2	2	DBCP EDB	N/A	N/A	N/A	N/A	N/A
CERCLIS (non-NPL)	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
DOD/DOE	1	1	1	TCE, PCE, Carbon Tetrachloride, Petroleum hydrocarbons	N/A	N/A	N/A	N/A	N/A
LUST	N/A	86	N/A	see below	N/A	N/A	N/A	45	N/A
RCRA Corrective Action	3	3	N/A	Petroleum hydrocarbons	N/A	N/A	N/A	N/A	N/A
Underground Injection	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
State Sites	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Non-point source	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Other specify	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A

N/A - not available

NPL - National Priority List

CERCLIS (non-NPL) - Comprehensive Environmental Response, Compensation, and Liability Information System

DOE - Department of Energy DOD - Department of Defense LUST - Leaking Underground Storage Tanks RCRA - Resource Conservation and Recovery Act

Table 5-3.c Ground Water Contamination Summary

Hydrogeologic Setting
 Spatial Description (optional)
 Map Available (optional)
 Data Reporting Period

Island of Oahu, Central Oahu Wellhead protection Area IV: Waialua Aquifer System
Refer to Map 1, Map 2, Map 3, Map 4
Yes
October 1995

Source Type	Number of sites	Number of sites that are listed and/or have confirmed releases	Number of sites with confirmed ground water contamination	Contaminants	Number of site investigations (optional)	Number of sites that have been stabilized or have had the source removed (optional)	Number of sites with corrective action plans (optional)	Number of sites with active remediation (optional)	Number of sites with cleanup completed (optional)
NPL	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
CERCLIS (non-NPL)	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
DOD/DOE	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
LUST	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
RCRA Corrective Action	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
Underground Injection	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
State Sites	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
Non-point source	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
Other specify	0	0	0	Pesticide use: DBCP, TCP	N/A	N/A	N/A	N/A	N/A

NPL - National Priority List

CERCLIS (non-NPL) - Comprehensive Environmental Response, Compensation, and Liability Information System

DOE - Department of Energy

DOD - Department of Defense

LUST - Leaking Underground Storage Tanks

RCRA - Resource Conservation and Recovery Act



Maui

The 1997 DOH Maui study had identified sugar and pineapple production activities as the major sources of groundwater contamination on the island. As noted on Tables 5-3.d through i, that there have not been any NPL, DOD, or RCRA corrective sites identified on Maui. There have been 77 releases of leaking underground storage tanks (LUST) on the island with 65 sites under or completed clean-up, and one site transferred to the Hazard Evaluation and Emergency Response Program. Unfortunately at the time of 1998 CWA 305 (b) report, we were not able to distinguish if any LUST sites had resided in the WHPAs.

Since agricultural activities, such as sugar, pineapple, and macadamia nut production, provide the major concerns for groundwater contamination on Maui, this section will describe the agricultural and other activities in the WHPAs identified in the 1997 wellhead vulnerability study. Refer to the following maps and tables for references:

- 1) Map 5-3.3 and Table 5.F for wells in the West Maui WHPAs located in the Lahaina Sector/Honolua, Honokowai, and Laniupoko Aquifer Systems;
- 2) Map 5-3.4 and Table 5.F for wells in the Central Maui WHPAs located in the Wailuku Sector/Iao Aquifer System, and for wells in the Central Maui WHPA located in the Central Sector/Kahului Aquifer System; and
- 4) Map 5-3.5 and Table 5.F for wells in the East Maui WHPA located in the Central Sector/Paia and Makawao Aquifer Systems.

West Maui

Kapalua WHPA: Lahaina Sector/Honolua Aquifer System

On West Maui four WHPA clusters were delineated. The north cluster is in this aquifer system which includes an area stretching from Napili to Kapalua. As noted in Table 5-3.d, the major source of groundwater contamination is pineapple production activities which is also the predominant land use activity. See Map 5-3.6 for land uses in west Maui. The WHPA in this aquifer region has been ranked with confirmed vulnerability. Two wells in Napili have been taken out of service because of high concentrations of DBCP.

The summary of groundwater quality in the Honolua aquifer system will be described in more detail in Chapter 4-4 of this report.

Insert Map 5-3.3 Insert Map 5-3.4 Insert Map 5-3.5

**Table 5.F Description of Maui Wells and Locational Data**

Aquifer Sector/System	Wells	Latitude	Longitude
Lahaina/Honolua	Kapalua 1 (5938-02)	205913	1563825
	Kapalua 2 (5938-03)	205918	1563801
	Honokohau A (5838-03)	205854	1563833
	Honokohau B (5938-01)	205901	1563825
	Napili A (5838-01)	205837	1562846
	Napili B (5838-02)	205839	1563831
	Napili C (5838-04)	205848	1563836
Lahaina/Honokowai	Kaanapali P1 (5539-01)	205548	1563930
	Kaanapali P2 (5539-02)	205558	1563921
	Kaanapali P4 (5739-01)	205705	1563908
	Kaanapali P5 (5738-01)	205724	1563859
	Kaanapali P6 (5739-02)	205735	1563902
	Hahakea 2 (5540-03)	205503	1564018
Lahaina/Launiupoko	Wahikuli 1 (5439-01)	205420	1563923
	Wahikuli 2 (5439-02)	205427	1563923
	Kanaha 1 (5339-03)	205344	1563930
	Kanaha 2 (5339-04)	205341	1563923
	Waipuka 1 (5339-01)	205320	1563945
	Waipuka 2 (5339-02)	205321	1563945
Wailuku/Iao	North Waihee 1 (5631-02)	205651	1563132
	North Waihee 2 (5631-03)	205651	1563130
	Waihee 1 (5431-02)	205440	1563102
	Waihee 2 (5431-03)	205440	1563101
	Waihee 3 (5431-04)	205444	1563104
	Waiehu Hts. A (5430-01)	205430	1563044
	Waiehu Hts. B (5430-02)	205432	1563044



Aquifer Sector/System	Wells	Latitude	Longitude
	Mokuhau 1 (5330-09)	205329	1563055
	Mokuhau 2 (5330-10)	205329	1563055
	Mokuhau 3 (5330-11)	205330	1563054
	Wailuku Shaft (5330-05)	205305	1563043
Central/Kahului	Reynolds Foods 1 (5129-01)	205159	1562907
	Reynolds Foods 2 (5129-07)	205208	1562848
Central/Paia&Makawao	Hamakuapoko 1 (5420-02)	205425	1562008
	Hamakuapoko 2 (5420-01)	205458	1562054
	Haiku (5419-01)	205410	1561940

Table 5-3.d Ground Water Contamination Summary

Hydrogeologic Setting
 Spatial Description (optional)
 Map Available (optional)
 Data Reporting Period

Island of Maui, West Maui Wellhead protection Area: Lahaina: Honolulu Aquifer System
Refer to Map
 Yes
 April 1997

Source Type	Number of sites	Number of sites that are listed and/or have confirmed releases	Number of sites with confirmed ground water contamination	Contaminants	Number of site investigations (optional)	Number of sites that have been stabilized or have had the source removed (optional)	Number of sites with corrective action plans (optional)	Number of sites with active remediation (optional)	Number of sites with cleanup completed (optional)
NPL	0	0	0	0	N/A	N/A	N/A	N/A	N/A
CERCLIS (non-NPL)	0	0	0	0	N/A	N/A	N/A	N/A	N/A
DOD/DOE	0	0	0	0	N/A		N/A	N/A	N/A
LUST	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
RCRA Corrective Action	0	0	0	0	N/A	N/A	N/A	N/A	N/A
Underground Injection	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
State Sites	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Non-point source	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Other: Pesticide usage for Pineapple	The area used for pineapple production surrounds 4 wells	2 wells have detections of contaminants	2 wells have detections of contaminants	DBCP Nitrates	N/A	N/A	N/A	N/A	N/A

NPL - National Priority List

CERCLIS (non-NPL) - Comprehensive Environmental Response, Compensation, and Liability Information System

DOE - Department of Energy



DOD - Department of Defense LUST - Leaking Underground Storage Tanks RCRA - Resource Conservation and Recovery Act



Kaanapali WHPAs: Lahaina Sector/Honokowai Aquifer System

These WHPAs includes the center clusters of wells that encompass the Kaanapali area. As noted in Table 5-3.e, the major sources of groundwater contamination are sugar and pineapple production activities. Map 5-3.6 shows that in one WHPA pineapple is cultivated and the other is in sugar production. There have not been any closures of wells in the area, but detections of contaminants associated with sugar and pineapple activities have been persistent. The north WHPA cluster encompassing the Kaanapali 4-6 wells is ranked with confirmed vulnerability, where as the other WHPA cluster is ranked with low vulnerability to contamination.

The summary of groundwater quality in the Honolua aquifer system will be described in more detail in Chapter 4-4 of this report.

Lahaina WHPAs: Lahaina Sector/Laniupoko Aquifer System

These WHPAs includes the southern clusters of wells that encompass the Lahaina area. As noted in Table 5-3.f, the major concern for groundwater contamination is sugar production activities. Map 5-3.6 shows this area in sugar production activities and there has not been any detection of associated organic chemical contaminants in the wells in this area, except for nitrate detection in one well. The 1997 DOH Maui study ranks this WHPA with low vulnerability to contamination.

The summary of groundwater quality in the Honolua aquifer system will be described in more detail in Chapter 4-4 of this report.

Central Maui

Iao WHPAs: Wailuku Sector/Iao Aquifer System

These WHPAs are located in the west upslope areas of Wailuku and Waihee and consist of a smaller semi-circle and a larger elongated WHPAs. As noted in Table 5-3.g, the major concern is macadamia nut production activities, see Map 5-3.7 for land uses in the Central WHPA areas. Macadamia nuts are cultivated upslope of the coast from north of Waihee to the mouth of Iao Valley near Wailuku. Housing can be found in the vicinity of the southern part of the WHPA. There have not been any detection of associated chemical contaminants in the wells in this aquifer region, but some nitrate concentrations have been detected. The DOH Maui study had ranked these WHPAs with low vulnerability



to contamination.

The summary of groundwater quality in the Honolulu aquifer system will be described in more detail in Chapter 4-4 of this report.

Table 5-3.e Ground Water Contamination Summary

Hydrogeologic Setting
 Spatial Description (optional)
 Map Available (optional)
 Data Reporting Period

Island of Maui, West Maui Wellhead protection Area: Lahaina: Honokowai Aquifer System
Refer to Map
 Yes
 April 1997

Source Type	Number of sites	Number of sites that are listed and/or have confirmed releases	Number of sites with confirmed ground water contamination	Contaminants	Number of site investigations (optional)	Number of sites that have been stabilized or have had the source removed (optional)	Number of sites with corrective action plans (optional)	Number of sites with active remediation (optional)	Number of sites with cleanup completed (optional)
NPL	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
CERCLIS (non-NPL)	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
DOD/DOE	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
LUST	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
RCRA Corrective Action	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Underground Injection	0	0	0	0	N/A	N/A	N/A	N/A	N/A
State Sites	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Non-point source	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Other: Pesticide usage for Sugar and Pineapple	The area used for pineapple and sugar production surrounds 6 wells	3 wells have detection of contaminants	3 wells have detection of contaminants	DBCP Nitrates TCP	N/A	N/A	N/A	N/A	N/A

NPL - National Priority List

CERCLIS (non-NPL) - Comprehensive Environmental Response, Compensation, and Liability Information System

DOE - Department of Energy DOD - Department of Defense LUST - Leaking Underground Storage Tanks RCRA - Resource Conservation and Recovery Act

Table 5-3.f Ground Water Contamination Summary

Hydrogeologic Setting
 Spatial Description (optional)
 Map Available (optional)
 Data Reporting Period

Island of Maui, West Maui Wellhead protection Area: Lahaina: Launiupoko Aquifer System
Refer to Map
 Yes
 April 1997

Source Type	Number of sites	Number of sites that are listed and/or have confirmed releases	Number of sites with confirmed ground water contamination	Contaminants	Number of site investigations (optional)	Number of sites that have been stabilized or have had the source removed (optional)	Number of sites with corrective action plans (optional)	Number of sites with active remediation (optional)	Number of sites with cleanup completed (optional)
NPL	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
CERCLIS (non-NPL)	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
DOD/DOE	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
LUST	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
RCRA Corrective Action	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Underground Injection	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
State Sites	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Non-point source	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Other: Pesticide usage for sugar	The area used for sugar production surrounds 6 wells	1 well has detection of contaminants	1 well has detection of contaminants	Nitrates	N/A	N/A	N/A	N/A	N/A

NPL - National Priority List

CERCLIS (non-NPL) - Comprehensive Environmental Response, Compensation, and Liability Information System

DOE - Department of Energy

DOD - Department of Defense LUST - Leaking Underground Storage Tanks RCRA - Resource Conservation and Recovery Act

Table 5-3.g Ground Water Contamination Summary

Hydrogeologic Setting
 Spatial Description (optional)
 Map Available (optional)
 Data Reporting Period

Island of Maui, Iao Wellhead protection Area: Wailuku: Iao Aquifer System
 Refer to Map
 Yes
 April 1997

Source Type	Number of sites	Number of sites that are listed and/or have confirmed releases	Number of sites with confirmed ground water contamination	Contaminants	Number of site investigations (optional)	Number of sites that have been stabilized or have had the source removed (optional)	Number of sites with corrective action plans (optional)	Number of sites with active remediation (optional)	Number of sites with cleanup completed (optional)
NPL	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
CERCLIS (non-NPL)	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
DOD/DOE	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
LUST	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
RCRA Corrective Action	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Underground Injection	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
State Sites	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Non-point source	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Other: Macadamia nut production	The area used for Mac nut production surrounds 8 wells	3 wells have detections of contamination	3 wells have detections of contamination	Nitrates	N/A	N/A	N/A	N/A	N/A

NPL - National Priority List

CERCLIS (non-NPL) - Comprehensive Environmental Response, Compensation, and Liability Information System

DOE - Department of Energy

DOD - Department of Defense LUST - Leaking Underground Storage Tanks RCRA - Resource Conservation and Recovery Act



Kahului WHPA: Central Sector/Kahului Aquifer System

This WHPA is located south of Kahului and as noted in Table 5-3.h. there are no major contaminant sources in the area. Former land uses in this undeveloped area are unknown, but plans have been made for suburban housing. Four former waste sites are located in the area southeast of Kahului, but contaminants found in the subsurface of these sites have not been detected in the two wells in the WHPA. But this WHPA is ranked with confirmed vulnerability from high levels of DBCP detected in the wells. This is attributed to long term leaching from upgradient pineapple fields outside the ten year time of travel boundary.

The summary of groundwater quality in the Honolua aquifer system will be described in more detail in Chapter 4-4 of this report.

East Maui WHPA: Central Sector/Paia and Makawao Aquifer Systems

This WHPA is located in east Maui in the vicinity of Haiku. As noted in Table 5-3.i the major source of contamination is from previous pineapple production activities. Currently, the wells in the area are not being used for public drinking water use, but Maui County is proposing to use the Haiku well as public drinking water sources. The WHPA is ranked with confirmed vulnerability to contamination because the Hamakuapoko wells have detected high levels of DBCP and nitrates. The source of this contamination is attributed to the former legal application of pesticides from a pineapple plantation surrounding the well.

The summary of groundwater quality in the Honolua aquifer system will be described in more detail in Chapter 4-4 of this report.

Table 5-3.h Ground Water Contamination Summary

Hydrogeologic Setting
 Spatial Description (optional)
 Map Available (optional)
 Data Reporting Period

Island of Maui, Central Maui Wellhead protection Area: Central: Kahului Aquifer System
 Refer to Map
 Yes
 April 1997

Source Type	Number of sites	Number of sites that are listed and/or have confirmed releases	Number of sites with confirmed ground water contamination	Contaminants	Number of site investigations (optional)	Number of sites that have been stabilized or have had the source removed (optional)	Number of sites with corrective action plans (optional)	Number of sites with active remediation (optional)	Number of sites with cleanup completed (optional)
NPL	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
CERCLIS (non-NPL)	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
DOD/DOE	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
LUST	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
RCRA Corrective Action	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Underground Injection	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
State Sites	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Non-point source	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Other: Pesticide usage from previous pineapple production	Previous pineapple production upgradient of wells	2 wells have detections of contaminants	2 wells have detections of contaminants	DBCP Nitrates	N/A	N/A	N/A	N/A	N/A

NPL - National Priority List
 CERCLIS (non-NPL) - Comprehensive Environmental Response, Compensation, and Liability Information System
 DOE - Department of Energy
 DOD - Department of Defense
 LUST - Leaking Underground Storage Tanks



RCRA - Resource Conservation and Recovery Act

Table 5-3.i Ground Water Contamination Summary

Hydrogeologic Setting
 Spatial Description (optional)
 Map Available (optional)
 Data Reporting Period

Island of Maui, East Maui Wellhead protection Area: Central: Paia/Makawao Aquifer Systems
 Refer to Map
 Yes
 April 1997

Source Type	Number of sites	Number of sites that are listed and/or have confirmed releases	Number of sites with confirmed ground water contamination	Contaminants	Number of site investigations (optional)	Number of sites that have been stabilized or have had the source removed (optional)	Number of sites with corrective action plans (optional)	Number of sites with active remediation (optional)	Number of sites with cleanup completed (optional)
NPL	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
CERCLIS (non-NPL)	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
DOD/DOE	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
LUST	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
RCRA Corrective Action	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Underground Injection	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
State Sites	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Non-point source	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Other: Pesticide usage from previous pineapple production	Previous pineapple production in the area surrounds 3 wells	3 wells have detections of contaminants	3 wells have detections of contaminants	DBCP EDB	N/A	N/A	N/A	N/A	N/A

NPL - National Priority List

CERCLIS (non-NPL) - Comprehensive Environmental Response, Compensation, and Liability Information System

DOE - Department of Energy DOD - Department of Defense LUST - Leaking Underground Storage Tanks RCRA - Resource Conservation and Recovery Act



Chapter 4-4

Summary of Groundwater Quality

In general, the concentration of chemical contaminants found in our wells have been detected at levels below state and federal drinking water standards. If detected concentrations in drinking water wells are greater than or equal to state and federal maximum contaminant levels (MCL), the well is taken out of service and treatment or contingency options are considered. Since the Central Oahu and Maui studies, one well in Central Oahu and four wells in Maui have been taken out of service.

Central Oahu

The major contaminants in the Central Oahu aquifers are 1, 2 Dibromo-3-chloropropane (DBCP), 1,1-Dichloro ethylene (DCE), 1,2-Dichloropropane (DCP), Ethylene dibromide (EDB), Tetrachloroethylene (PCE), Trichloroethylene (TCE), and 1,2,3-Trichloropropane (TCP). As described in Chapter 4-3, the primary contamination sources are attributed to sugar and pineapple production, and military installations and storage facilities. Since the 1995 DOH wellhead study, one well in Wahiawa, Del Monte Pump 3, has been taken out of service. The following will describe the contaminants identified in the DOH study and compare current monitoring levels.

WHPA I: Pearl Harbor Aquifer Sector/Kunia & Waipahu & Waiawa Aquifer Systems

As described in the previous section, this aquifer area contains the superfund site, Del Monte Oahu Plantation. The detection of DBCP and EDB during the 1980 investigation, 11 ppb and 300 ppb respectively, prompted the closure of plantation well (Currently the MCL for both is 0.04). Also during the 1980s, DBCP was detected in Mililani I and II wells, EDB was detected in Waipahu wells, DBCP was detected in Kunia II wells. All three areas have treatment facilities using granular activated carbon to treat the source waters. The cost of installing the treatment units were \$2.5 million for the Mililani wells, \$3.2 million for the Waipahu wells, and \$750,000 for the Kunia II wells.

Untreated water quality data from public water supply wells was used for Table 5-4.a. This table describes the status of the aquifers in tracking contamination concentrations from volatile organic chemicals (VOC), synthetic organic chemical (SOC), nitrates (NO₂), and EDB and DBCP. Of the 37 wells identified in this area, 17 required treatment using granular



activated carbon (GAC) units, and:

- C 12 have shown detections of VOCs, where the concentrations in 6 wells exceeded the maximum contaminant level (MCL) for TCP;
- C 3 have shown detections of SOC's but below MCLs;
- C 33 have shown detections of nitrates;
- C 9 have shown a detection of EDB, where concentration in one well exceeded the MCL; and

Table 5-4.a Aquifer Monitoring Data

Hydrogeologic Setting
 Spatial Description (optional)
 Map Available (optional)
 Data Reporting Period

Island of Oahu, Central Oahu Wellhead protection Area I: Kunia/Waipahu/Waiawa Aquifer Systems
 Refer to Table 5.E
 Refer to Map 5.3
 October 1995 for the wellhead assessment; September 1997 for current monitoring data

Monitoring Data Type	Total No. of Wells Used in the Assessment ⁽⁵⁾	Parameter Groups	Number of Wells								
			No detections of parameters above MDLs or background levels		Nitrate concentrations range from background levels to less than or equal to 5 mg/l No detections or parameters other than nitrate above MDLs or background levels and/or located in areas that are sensitive or vulnerable		Nitrate ranges from greater than 5 to less than or equal to 10 mg/l Other parameters are detected at concentrations exceeding the MDL but are less than or equal to the MCLs ⁽¹⁰⁾	Parameters are detected at concentrations exceeding the MCLs ⁽¹¹⁾	Number of Wells Removed from service ⁽¹²⁾	Number of Wells Requiring Special Treatment <i>Treatment method is granular activated charcoal</i>	Background parameters exceed MCLs ⁽¹⁴⁾
			ND ⁽⁶⁾	Number of wells in sensitive or vulnerable areas (optional)	Nitrate # 5 mg/l VOC, SOC, and Other parameters not detected ⁽⁸⁾	Number of wells in sensitive or vulnerable areas (optional)					
Ambient Monitoring Network (optional)		VOC									
		SOC ⁽¹⁵⁾									
		NO ₂									
		Other ⁽¹⁶⁾									
Untreated Water Quality Data from Public Water Supply Wells	37	VOC	25		33/10		4/12	6	0	17	0
	37	SOC ⁽¹⁵⁾	34		33/34		4/3	0	0	17	0
	37	NO ₂	4		33		4	0	0		0
	37	Other EDB	28		33/29		4/9	1	0	17	0
		DBCP	26		33/27		4/11	8	0	17	0
Finished Water Quality Data from Public Water Supply Wells		VOC									
		SOC ⁽¹⁵⁾									
		NO ₂									
		Other ⁽¹⁶⁾									

Major uses of the aquifer or hydrologic unit

☒ Public water supply ☐ Irrigation ☐ Commercial ☐ Mining ☐ Baseflow Maintenance
☐ Private water supply ☐ Thermoelectric ☐ Livestock ☐ Industrial



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Uses affected by water quality problems (optional) ⁽⁸⁾	<input type="checkbox"/> Public water supply	<input type="checkbox"/> Irrigation	<input type="checkbox"/> Commercial	<input type="checkbox"/> Mining	<input type="checkbox"/> Baseflow Maintenance
	<input type="checkbox"/> Private water supply	<input type="checkbox"/> Thermoelectric	<input type="checkbox"/> Livestock	<input type="checkbox"/> Industrial	



C 11 have shown detections of DBCP, where the concentration in 8 wells exceeded the MCL.

Table 5-4.a.1 shows the current status of groundwater contamination in the Kunia, Waipahu, and Waiawa aquifer systems⁷

WHPA II and III: Central Sector/Wahiawa Aquifer System

WHPA II encompasses a portion of Schofield Barracks that contained an auto craft shop, but remedial investigations concluded that petroleum hydrocarbons are the only contaminant released to the subsurface. The well in this area, Del Monte Pump 3 had been showing concentrations of carbon tetrachloride, DCE, PCE, and TCE. Currently the well has been taken out of service.

WHPA III encompasses the majority of Schofield Barracks. When initial investigations were performed in 1985, TCE was found in concentrations of 10 to 40 ppb and PCE was found at a concentration of 1 ppb (U.S. Army, 1994). The Wahiawa wellfields in this area had shown concentrations of PCE, carbon tetrachloride, and DBCP.

Untreated water quality data from public water supply wells was used for Table 5-4.b. This table describes the status of the aquifers in tracking contamination concentrations from volatile organic chemicals (VOC), synthetic organic chemical (SOC), nitrates (NO₂), and EDB and DBCP. Of the 11 wells identified in this area, 6 required treatment using an air stripping unit at the Schofield water treatment plant, and:

C all 11 have shown detections of VOCs, where the primary contaminants were carbon tetrachloride, PCE, TCE, and TCP. The Schofield Battery wellfield comprising of 6 wells (at the time of the study) had shown TCE concentrations exceeding MCLs, but levels were non-detectable after treatment;

C none have shown detections of SOC. DOH Groundwater Contamination Maps have shown detections of Atrazine and metabolites from 1992-1993 sampling dates and recent DOH monitoring data have not shown any detections;

C 5 have shown detections of nitrates; and

C 1 have shown a detection of DBCP

Table 5-4.a.2 shows the current status of groundwater contamination in the Wahiawa aquifer systems⁸



WHPA IV: North Sector/Waialua Aquifer System

As described in Chapter 4-3, the area does not contain any major contamination sources or facilities. Because of predominant agricultural activities, such as pineapple and diversified production, there has been detections of DBCP and TCP, but at levels below state levels.

Untreated water quality data from public water supply wells was used for Table 5-4.c. This table describes the status of the aquifers in tracking contamination concentrations from volatile organic chemicals (VOC), synthetic organic chemical (SOC), nitrates (NO₂), and EDB and DBCP. Of the 6 wells identified in this area:

2 have shown detections of VOCs, where the primary contaminants were TCE, and TCP;

Table 5-4.b Aquifer Monitoring Data

Hydrogeologic Setting
Spatial Description (optional)
Map Available (optional)
Data Reporting Period

Island of Oahu, Central Oahu Wellhead protection Areas II & III: Wahiawa Aquifer System
Refer to Table 5.E
Refer to Map 5.3
October 1995 for the wellhead assessment; September 1997 for current monitoring data

Monitoring Data Type	Total No. of Wells Used in the Assessment ⁽⁵⁾	Parameter Groups	Number of Wells								
			No detections of parameters above MDLs or background levels		Nitrate concentrations range from background levels to less than or equal to 5 mg/l No detections or parameters other than nitrate above MDLs or background levels and/or located in areas that are sensitive or vulnerable		Nitrate ranges from greater than 5 to less than or equal to 10 mg/l Other parameters are detected at concentrations exceeding the MDL but are less than or equal to the MCLs ⁽¹⁰⁾	Parameters are detected at concentrations exceeding the MCLs ⁽¹¹⁾	Number of Wells Removed from service ⁽¹²⁾	Number of Wells Requiring Special Treatment ⁽¹³⁾ <i>Treatment method is air stripping</i>	Background parameters exceed MCLs ⁽¹⁴⁾
			ND ⁽⁶⁾	Number of wells in sensitive or vulnerable areas ⁽⁸⁾ (optional)	Nitrate # 5 mg/l VOC, SOC, and Other parameters not detected ⁽⁸⁾	Number of wells in sensitive or vulnerable areas ⁽⁸⁾ (optional)					
Ambient Monitoring Network (optional)		VOC									
		SOC ⁽¹⁵⁾									
		NO ₃									
		Other ⁽¹⁶⁾									
Untreated Water Quality Data from Public Water Supply Wells	11	VOC	0		5/0		0	6	0	6	0
	11	SOC ⁽¹⁵⁾	11		5/11		0	0	0	0	0
	11	NO ₃	0		5		0	0	0	0	0
	11	Other DBCP EDB	10 11		5/10 5/11		0 0	0 0	0 0	0 0	0 0
Finished Water Quality Data from Public Water Supply Wells		VOC									
		SOC ⁽¹⁵⁾									
		NO ₃									
		Other ⁽¹⁶⁾									

Major uses of the aquifer or hydrologic unit	<input checked="" type="checkbox"/> Public water supply <input type="checkbox"/> Irrigation <input type="checkbox"/> Commercial <input type="checkbox"/> Mining <input type="checkbox"/> Baseflow Maintenance <input type="checkbox"/> Private water supply <input type="checkbox"/> Thermoelectric <input type="checkbox"/> Livestock <input type="checkbox"/> Industrial				
Uses affected by water quality problems (optional) ⁽⁸⁾	<input type="checkbox"/> Public water supply <input type="checkbox"/> Irrigation <input type="checkbox"/> Commercial <input type="checkbox"/> Mining <input type="checkbox"/> Baseflow Maintenance <input type="checkbox"/> Private water supply <input type="checkbox"/> Thermoelectric <input type="checkbox"/> Livestock <input type="checkbox"/> Industrial				

Table 5-4.c Aquifer Monitoring Data

Hydrogeologic Setting
Spatial Description (optional)
Map Available (optional)
Data Reporting Period

Island of Oahu, Central Oahu Wellhead protection Area IV: Waialua Aquifer System
Refer to Table 5.E
Refer to Map 5.3
October 1995 for the wellhead assessment; September 1997 for current monitoring data

Monitoring Data Type	Total No. of Wells Used in the Assessment ⁽⁵⁾	Parameter Groups	Number of Wells								
			No detections of parameters above MDLs or background levels		Nitrate concentrations range from background levels to less than or equal to 5 mg/l No detections or parameters other than nitrate above MDLs or background levels and/or located in areas that are sensitive or vulnerable		Nitrate ranges from greater than 5 to less than or equal to 10 mg/l Other parameters are detected at concentrations exceeding the MDL but are less than or equal to the MCLs ⁽¹⁰⁾	Parameters are detected at concentrations exceeding the MCLs ⁽¹¹⁾	Number of Wells Removed from service ⁽¹²⁾	Number of Wells Requiring Special Treatment ⁽¹³⁾	Background parameters exceed MCLs ⁽¹⁴⁾
			ND ⁽⁶⁾	Number of wells in sensitive or vulnerable areas ⁽⁸⁾ (optional)	Nitrate # 5 mg/l VOC, SOC, and Other parameters not detected ⁽⁸⁾	Number of wells in sensitive or vulnerable areas ⁽⁸⁾ (optional)					
Ambient Monitoring Network (optional)		VOC									
		SOC ⁽¹⁵⁾									
		NO ₂									
		Other ⁽¹⁶⁾									
Untreated Water Quality Data from Public Water Supply Wells	6	VOC	4		2/5		0/1	0	0	0	0
	6	SOC ⁽¹⁵⁾	6		2/6		0/1	0	0	0	0
	6	NO ₂	4		2		0	0	0	0	0
	6	Other DBCP EDB	3 6		2/3 2/0		0/4 0/0	0 0	0 0	0 0	0 0
Finished Water Quality Data from Public Water Supply Wells		VOC									
		SOC ⁽¹⁵⁾									
		NO ₂									
		Other ⁽¹⁶⁾									

Major uses of the aquifer or hydrologic unit	<input checked="" type="checkbox"/> Public water supply <input type="checkbox"/> Irrigation <input type="checkbox"/> Commercial <input type="checkbox"/> Mining <input type="checkbox"/> Baseflow Maintenance <input type="checkbox"/> Private water supply <input type="checkbox"/> Thermoelectric <input type="checkbox"/> Livestock <input type="checkbox"/> Industrial
⁽⁸⁾ Uses affected by water quality problems (optional)	<input type="checkbox"/> Public water supply <input type="checkbox"/> Irrigation <input type="checkbox"/> Commercial <input type="checkbox"/> Mining <input type="checkbox"/> Baseflow Maintenance <input type="checkbox"/> Private water supply <input type="checkbox"/> Thermoelectric <input type="checkbox"/> Livestock <input type="checkbox"/> Industrial



Table 5-4.a.1 Groundwater Contamination in the Pearl Harbor Aquifer Sector/Kunia, Waipahu, and Waiawa Aquifer Systems

Wells	Contaminant	Detected Level (in ppb)	Date Sampled
Mililani I: (2800-01 to 04)	DBCP before treatment	0.15	7/22/97
	DBCP after treatment	<0.02 ND	7/22/97
	DCP before treatment	<1.0 NQ	7/22/97
	DCP after treatment	<0.3 ND	7/22/97
	TCP before treatment	2.9	7/22/97
	TCP after treatment	<0.2 ND	7/22/97
Mililani II: (2859-01 to 02)	DBCP before treatment	0.17	7/22/97
	DBCP after treatment	<0.02 ND	7/22/97
	DCP before treatment	<1.0 NQ	7/22/97
	DCP after treatment	<0.3 ND	7/22/97
	TCP before treatment	2.6	7/22/97
	TCP after treatment	<0.2 ND	7/22/97
Mililani III: (2600-03 to-04)	DBCP before treatment	0.06	7/22/97
	DBCP after treatment	<0.02 ND	7/22/97
	DCP before treatment	<1.0 NQ	7/22/97
	DCP after treatment	<1.0 NQ	7/22/97
	TCP before treatment	1.9	7/22/97
	TCP after treatment	<0.2 ND	7/22/97
Waipio Hts II: (2500-01 to 02)	TCE	0.5	3/7/97
	TCP	0.7	3/7/97
Waipio Hts III: (2659-02 to 03)	EDB	<0.04 NQ	7/22/97
	TCP	<0.5 NQ	7/22/97
Waipahu Wells: (2400-02 to 04)	EDB before treatment	<0.04 NQ	7/22/97
	EDB after treatment	<0.01 ND	7/22/97
	TCP before treatment	<0.5 NQ	7/22/97
	TCP after treatment	<0.2 ND	7/22/97
Waipahu II: (2400-05 to 06)	EDB before treatment	0.04	7/24/97
	EDB after treatment	<0.01 ND	7/24/97
	TCP before treatment	<0.5 NQ	7/24/97
	TCP after treatment	<0.5 NQ	7/24/97
Hoaeae Well 1: (2301-34 to 39)	Atrazine	0.063	8/26/96
	Desethyl Atrazine	<0.10	9/28/93
	TCP	<0.5 NQ	5/22/97
Dairy Company: (2600-02)	TCE	<0.5 NQ	7/23/97
	TCP	<0.5 NQ	7/23/97
Kunia I: (2303-01 to 04)	Atrazine	0.085	1/23/97
	Desethyl Atrazine	<0.10	9/28/93
	TCP	0.7	5/21/97



Wells	Contaminant	Detected Level (in ppb)		Date Sampled
Kunia II: (2402-01 to 03)	Atrazine	<0.10		9/28/93
	Desethyl Atrazine	<0.10		9/28/93
	DBCP before treatment	0.04	NQ	5/22/97
	after treatment	<0.02	ND	5/22/97
	TCP before treatment	1.0		5/22/97
	after treatment	<0.2	ND	5/22/97
	TCE before treatment	1.0		5/22/97
	after treatment	<0.2	ND	5/22/97
Hawaii Country Club (2603-01)	DBCP before treatment	0.06		7/24/97
	after treatment	<0.02	ND	7/24/97
	EDB before treatment	<0.04	NQ	7/24/97
	after treatment	<0.01	NQ	7/24/97
	TCP before treatment	<0.5		7/24/97
	after treatment	<0.2	ND	7/24/97

**Table 5-4.a.2 Groundwater Contamination in the Central Aquifer
Sector/Wahiawa Aquifer System**

Wells	Contaminant	Detected levels (in ppb)		Date Sampled
Wahiawa Wells: (2901-08, 11-12)	Carbon Tetrachloride	0.6		4/17/97
	PCE	1.2		4/17/97
	DBCP	<0.04	NQ	4/17/97
Wahiawa 2: (2902-02)	Carbon Tetrachloride	<0.5	NQ	4/23/97
	PCE	<0.5	NQ	4/23/97
Schofield Battery: (2901-02 to 04, 06 to 07, 10)	TCE before treatment	11.5		7/22/97
	after treatment	<0.2	ND	7/22/97
	PCE before treatment	<0.5	NQ	7/22/97
	after treatment	<0.2	ND	7/22/97



**Table 5-4.a.3 Groundwater Contamination in the North Aquifer
Sector/Waialua Aquifer System**

Wells	Contaminant	Detected level (in ppb)		Sampling Date
Haleiwa 1 & 2 (3405-03 and 04)	DBCP	0.04		7/31/97
	TCP	<0.5	NQ	7/31/97
Waialua Wells: (3405-01 to 02), (3505-12) (3307-01*) *central pump that draws water from wells 3307-01 to -14	TCE	<0.5	NQ	4/25/97
	TCP	<0.5	NQ	4/25/97
	DBCP	<0.04	NQ	7/29/96
	Atrazine	0.12		11/04/92
	Desethyl Atrazine	0.15		11/04/92

C none have shown recent detections of SOC's. DOH Groundwater Contamination Maps have shown detections of Atrazine and metabolites from 1992-1993 sampling dates and recent DOH monitoring data have not shown any detections;

C 2 have shown detections of nitrates; and

C 3 have shown a detection of DBCP.

Table 5-4.a.3 shows the current status of groundwater contamination in the Wahiawa aquifer systems⁹.

Maui

The major contaminants identified in the 1997 DOH Maui wellhead vulnerability study were 1, 2 Dibromo-3-chloropropane (DBCP), Ethylene dibromide (EDB), and 1,2,3-Trichloropropane (TCP). As described in Chapter 4-3, the primary contamination sources are attributed to pineapple production, and concerns for other activities such as macadamia nut production and increased residential activities.

Since the study, three wells referenced in the report was taken out of service, Napili A in West Maui, and Reynolds Foods 1 and 2 in Central Maui. The East Maui Hamakuapoko Wells 1 and 2 were proposed for drinking water use, but persistent DBCP concentrations have taken them out of consideration. The following will describe the contaminants identified in the DOH study and compare current monitoring levels.

Table 5-4.a.4 shows the current status of groundwater contamination on Maui¹⁰.



West Maui

Kapalua WHPA: Lahaina Sector/Honolua Aquifer System

This WHPA is in an area where pineapple production is still active. The 1997 study identified two wells contaminated by DBCP to levels in excess of state drinking water standards. Since then, one well, Napili A, has been taken out of service, and other wells in the WHPA have not shown any detections of DBCP.

Untreated water quality data from public water supply wells was used for Table 5-4.d. This table describes the status of the aquifers in tracking contamination concentrations from volatile organic chemicals (VOC), synthetic organic chemical (SOC), nitrates (NO_2), and EDB and DBCP. Of the 7 wells identified in this area, 1 was taken out of service, and:

- C none have shown detections of VOCs;
- C none have shown detections of SOC's;
- C 3 have shown detections of nitrates; and
- C none have shown a detection of DBCP (since Napili A was taken out of service)



Table 5-4.a.4 Groundwater Contamination in the West, Central, and East WHPA wells on Maui

Wells	Contaminant	Detected Level (in ppb)	Date Sampled
Kaanapali P4: (5739-01)	TCP before treatment	1.3	5/19/97
	after treatment	<0.2 ND	8/6/97
	DBCP before treatment	<0.152	8/6/97
	after treatment	<0.02 ND	8/6/97
Kaanapali P5 (5738-01)	TCP before treatment	1.1	5/19/97
	after treatment	<0.2 ND	8/6/97
	DBCP before treatment	0.22	8/6/97
	after treatment	<0.02 ND	8/6/97
Kaanapali P6: (5739-02)	TCP before treatment	0.8	5/19/97
	after treatment	<0.2 ND	8/6/97
	DBCP before treatment	0.13	8/6/97
	after treatment	<0.02 ND	8/6/97
Napili A (5838-01) (Closed)	DBCP	0.360	6/4/93
Reynolds #1 (5228-06) (taken out of service)	DBCP	<0.04 NQ More recent data has been provided but unavailable at the time of this report.	2/16/93

Table 5-4.d Aquifer Monitoring Data

Hydrogeologic Setting
Spatial Description (optional)
Map Available (optional)
Data Reporting Period

Island of Maui, West Maui Wellhead protection Area: Lahaina: Honolulu Aquifer System
Refer to Table 5.F
Refer to Map 5.4
October 1995 for the wellhead assessment; September 1997 for current monitoring data

Monitoring Data Type	Total No. of Wells Used in the Assessment ⁽⁵⁾	Parameter Groups	Number of Wells								
			No detections of parameters above MDLs or background levels		Nitrate concentrations range from background levels to less than or equal to 5 mg/l No detections or parameters other than nitrate above MDLs or background levels and/or located in areas that are sensitive or vulnerable		Nitrate ranges from greater than 5 to less than or equal to 10 mg/l Other parameters are detected at concentrations exceeding the MDL but are less than or equal to the MCLs ⁽¹⁰⁾	Parameters are detected at concentrations exceeding the MCLs ⁽¹¹⁾	Number of Wells Removed from service ⁽¹²⁾	Number of Wells Requiring Special Treatment ⁽¹³⁾	Background parameters exceed MCLs ⁽¹⁴⁾
			ND ⁽⁶⁾	Number of wells in sensitive or vulnerable areas ⁽⁷⁾	Nitrate # 5 mg/l VOC, SOC, and Other parameters not detected ⁽⁸⁾	Number of wells in sensitive or vulnerable areas ⁽⁹⁾					
Ambient Monitoring Network (optional)		VOC									
		SOC ⁽¹⁵⁾									
		NO ₂									
		Other ⁽¹⁶⁾									
Untreated Water Quality Data from Public Water Supply Wells	7	VOC	7		3/7		0	0	0	0	0
	7	SOC ⁽¹⁵⁾	7		3/7		0	0	0	0	0
	7	NO ₂	4		3		0	0	0	0	0
	7	Other DBCP EDB	6 7		3/0 3/0		0 0	0 0	1 0	0 0	0 0
Finished Water Quality Data from Public Water Supply Wells		VOC									
		SOC ⁽¹⁵⁾									
		NO ₂									
		Other ⁽¹⁶⁾									

Major uses of the aquifer or hydrologic unit	<input checked="" type="checkbox"/> Public water supply <input type="checkbox"/> Irrigation <input type="checkbox"/> Commercial <input type="checkbox"/> Mining <input type="checkbox"/> Baseflow Maintenance <input type="checkbox"/> Private water supply <input type="checkbox"/> Thermoelectric <input type="checkbox"/> Livestock <input type="checkbox"/> Industrial				
Uses affected by water quality problems (optional) ⁽⁸⁾	<input type="checkbox"/> Public water supply <input type="checkbox"/> Irrigation <input type="checkbox"/> Commercial <input type="checkbox"/> Mining <input type="checkbox"/> Baseflow Maintenance <input type="checkbox"/> Private water supply <input type="checkbox"/> Thermoelectric <input type="checkbox"/> Livestock <input type="checkbox"/> Industrial				



Kaanapali WHPAs: Lahaina Sector/Honokowai Aquifer System

As described in Chapter 4-3, the primary sources of contamination are attributed to the legal application of pesticides from pineapple production activities. The 1997 study had identified two wells contaminated with DBCP in excess of state drinking water standards. Since, three wells have persistent detections of DBCP and TCP.

Untreated water quality data from public water supply wells was used for Table 5-4.e. This table describes the status of the aquifers in tracking contamination concentrations from volatile organic chemicals (VOC), synthetic organic chemical (SOC), nitrates (NO_2), and EDB and DBCP. Of the 6 wells identified in this area:

- C 3 have shown detections of VOCs coming from TCP detections;
- C none have shown detections of SOCs;
- C 4 have shown detections of nitrates; and
- C 3 have shown detections of DBCP.

Lahaina WHPAs: Lahaina Sector/Laniupoko Aquifer System

As described in Chapter 4-3, sugar cane is the primary land use activities near the wells. There have not been any detection of contaminants from these wells except for nitrate detection in Kanaha 1 well.

Untreated water quality data from public water supply wells was used for Table 5-4.f. This table describes the status of the aquifers in tracking contamination concentrations from volatile organic chemicals (VOC), synthetic organic chemical (SOC), nitrates (NO_2), and EDB and DBCP. Of the 6 wells identified in this area:

- C none have shown detections of VOCs;
- C none have shown detections of SOCs;
- C one have shown detections of nitrates; and
- C none have shown detections of DBCP or EDB.

Central Maui

Iao WHPAs: Wailuku Sector/Iao Aquifer System

As described in Chapter 4-3, there have not been any detection of contaminants in the wells in this WHPA. The current land use activities of macadamia nut production and residential development have resulted in the detection of low concentrations of nitrates.



Untreated water quality data from public water supply wells was used for Table 5-4.g. This table describes the status of the aquifers in tracking contamination concentrations from volatile organic chemicals (VOC), synthetic organic chemical (SOC), nitrates (NO_2),

Table 5-4.e Aquifer Monitoring Data

Hydrogeologic Setting
Spatial Description (optional)
Map Available (optional)
Data Reporting Period

Island of Maui, West Maui Wellhead protection Area: Lahaina: Honokowai Aquifer System
Refer to Table 5.F
Refer to Map 5.4
October 1995 for the wellhead assessment; September 1997 for current monitoring data

Monitoring Data Type	Total No. of Wells Used in the Assessment ⁽⁵⁾	Parameter Groups	Number of Wells								
			No detections of parameters above MDLs or background levels		Nitrate concentrations range from background levels to less than or equal to 5 mg/l No detections or parameters other than nitrate above MDLs or background levels and/or located in areas that are sensitive or vulnerable		Nitrate ranges from greater than 5 to less than or equal to 10 mg/l Other parameters are detected at concentrations exceeding the MDL but are less than or equal to the MCLs ⁽¹⁰⁾	Parameters are detected at concentrations exceeding the MCLs ⁽¹¹⁾	Number of Wells Removed from service ⁽¹²⁾	Number of Wells Requiring Special Treatment ⁽¹³⁾ <i>Blending and aeration</i>	Background parameters exceed MCLs ⁽¹⁴⁾
			ND ⁽⁶⁾	Number of wells in sensitive or vulnerable areas (optional) ⁽⁹⁾	Nitrate # 5 mg/l VOC, SOC, and Other parameters not detected ⁽⁸⁾	Number of wells in sensitive or vulnerable areas (optional) ⁽⁹⁾					
Ambient Monitoring Network (optional)		VOC									
		SOC ⁽¹⁵⁾									
		NO ₂									
		Other ⁽¹⁶⁾									
Untreated Water Quality Data from Public Water Supply Wells	6	VOC	3		4/3		0/3	0	0	0	0
	6	SOC ⁽¹⁵⁾	6		4/6		0/0	0	0	0	0
	6	NO ₂	2		4		0/0	0	0	0	0
	6	Other DBCP EDB	3 6		4/3 4/6		0/3 0/0	3 0	0 0	4 0	0 0
Finished Water Quality Data from Public Water Supply Wells		VOC									
		SOC ⁽¹⁵⁾									
		NO ₂									
		Other ⁽¹⁶⁾									

Major uses of the aquifer or hydrologic unit	<input checked="" type="checkbox"/> Public water supply	<input type="checkbox"/> Irrigation	<input type="checkbox"/> Commercial	<input type="checkbox"/> Mining	<input type="checkbox"/> Baseflow Maintenance
	<input type="checkbox"/> Private water supply	<input type="checkbox"/> Thermoelectric	<input type="checkbox"/> Livestock	<input type="checkbox"/> Industrial	
Uses affected by water quality problems (optional) ⁽⁸⁾	<input type="checkbox"/> Public water supply	<input type="checkbox"/> Irrigation	<input type="checkbox"/> Commercial	<input type="checkbox"/> Mining	<input type="checkbox"/> Baseflow Maintenance
	<input type="checkbox"/> Private water supply	<input type="checkbox"/> Thermoelectric	<input type="checkbox"/> Livestock	<input type="checkbox"/> Industrial	

Table 5-4.f Aquifer Monitoring Data

Hydrogeologic Setting
 Spatial Description (optional)
 Map Available (optional)
 Data Reporting Period

Island of Maui, West Maui Wellhead protection Area: Lahaina: Launiupoko Aquifer System
 Refer to Table 5.F
 Refer to Map 5.4
 October 1995 for the wellhead assessment; September 1997 for current monitoring data

Monitoring Data Type	Total No. of Wells Used in the Assessment ⁽⁵⁾	Parameter Groups	Number of Wells								
			No detections of parameters above MDLs or background levels		Nitrate concentrations range from background levels to less than or equal to 5 mg/l No detections or parameters other than nitrate above MDLs or background levels and/or located in areas that are sensitive or vulnerable		Nitrate ranges from greater than 5 to less than or equal to 10 mg/l Other parameters are detected at concentrations exceeding the MDL but are less than or equal to the MCLs ⁽¹⁰⁾	Parameters are detected at concentrations exceeding the MCLs ⁽¹¹⁾	Number of Wells Removed from service ⁽¹²⁾	Number of Wells Requiring Special Treatment ⁽¹³⁾	Background parameters exceed MCLs ⁽¹⁴⁾
			ND ⁽⁶⁾	Number of wells in sensitive or vulnerable areas ⁽⁸⁾ (optional)	Nitrate # 5 mg/l VOC, SOC, and Other parameters not detected ⁽⁸⁾	Number of wells in sensitive or vulnerable areas ⁽⁹⁾ (optional)					
Ambient Monitoring Network (optional)		VOC									
		SOC ⁽¹⁵⁾									
		NO ₂									
		Other ⁽¹⁶⁾									
Untreated Water Quality Data from Public Water Supply Wells	6	VOC	6		0		0	0	0	0	0
	6	SOC ⁽¹⁵⁾	6		0		0	0	0	0	0
	6	NO ₂	5		1/0		0	0	0	0	0
	6	Other DBCP EDR	6 6		0 0		0 0	0 0	0 0	0 0	0 0
Finished Water Quality Data from Public Water Supply Wells		VOC									
		SOC ⁽¹⁵⁾									
		NO ₂									
		Other ⁽¹⁶⁾									

Major uses of the aquifer or hydrologic unit	<input checked="" type="checkbox"/> Public water supply	<input type="checkbox"/> Irrigation	<input type="checkbox"/> Commercial	<input type="checkbox"/> Mining	<input type="checkbox"/> Baseflow Maintenance
	<input type="checkbox"/> Private water supply	<input type="checkbox"/> Thermoelectric	<input type="checkbox"/> Livestock	<input type="checkbox"/> Industrial	



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Uses affected by water quality problems (optional) (8)	<input type="checkbox"/> Public water supply	<input type="checkbox"/> Irrigation	<input type="checkbox"/> Commercial	<input type="checkbox"/> Mining	<input type="checkbox"/> Baseflow Maintenance
	<input type="checkbox"/> Private water supply	<input type="checkbox"/> Thermoelectric	<input type="checkbox"/> Livestock	<input type="checkbox"/> Industrial	

Table 5-4.g Aquifer Monitoring Data

Hydrogeologic Setting
 Spatial Description (optional)
 Map Available (optional)
 Data Reporting Period

Island of Maui, Iao Wellhead protection Area: Wailuku: Iao Aquifer System
 Refer to Table 5.F
 Refer to Map 5.4
 October 1995 for the wellhead assessment; September 1997 for current monitoring data

Monitoring Data Type	Total No. of Wells Used in the Assessment ⁽⁵⁾	Parameter Groups	Number of Wells								
			No detections of parameters above MDLs or background levels		Nitrate concentrations range from background levels to less than or equal to 5 mg/l No detections or parameters other than nitrate above MDLs or background levels and/or located in areas that are sensitive or vulnerable		Nitrate ranges from greater than 5 to less than or equal to 10 mg/l Other parameters are detected at concentrations exceeding the MDL but are less than or equal to the MCLs ⁽¹⁰⁾	Parameters are detected at concentrations exceeding the MCLs ⁽¹¹⁾	Number of Wells Removed from service ⁽¹²⁾	Number of Wells Requiring Special Treatment ⁽¹³⁾	Background parameters exceed MCLs ⁽¹⁴⁾
			ND ⁽⁶⁾	Number of wells in sensitive or vulnerable areas (optional) ⁽⁷⁾	Nitrate # 5 mg/l VOC, SOC, and Other parameters not detected ⁽⁸⁾	Number of wells in sensitive or vulnerable areas (optional) ⁽⁹⁾					
Ambient Monitoring Network (optional)		VOC									
		SOC ⁽¹⁵⁾									
		NO ₂									
		Other ⁽¹⁶⁾									
Untreated Water Quality Data from Public Water Supply Wells	11	VOC	11		0/0		0	0	0	0	0
	11	SOC ⁽¹⁵⁾	11		0/0		0	0	0	0	0
	11	NO ₂	8		3/0		0	0	0	0	0
	11	Other DBCP EDB	11 11		0/0 0/0		0 0	0 0	0 0	0 0	0 0
Finished Water Quality Data from Public Water Supply Wells		VOC									
		SOC ⁽¹⁵⁾									
		NO ₂									
		Other ⁽¹⁶⁾									

Major uses of the aquifer or hydrologic unit

☒ Public water supply ☐ Irrigation ☐ Commercial ☐ Mining ☐ Baseflow Maintenance
☐ Private water supply ☐ Thermoelectric ☐ Livestock ☐ Industrial



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Uses affected by water quality problems (optional) (8)	<input type="checkbox"/> Public water supply	<input type="checkbox"/> Irrigation	<input type="checkbox"/> Commercial	<input type="checkbox"/> Mining	<input type="checkbox"/> Baseflow Maintenance
	<input type="checkbox"/> Private water supply	<input type="checkbox"/> Thermoelectric	<input type="checkbox"/> Livestock	<input type="checkbox"/> Industrial	



and EDB and DBCP.

Of the 11 wells identified in this area:

- ☐ none have shown detections of VOCs;
- ☐ none have shown detections of SOC's;
- ☐ three have shown detections of nitrates; and
- ☐ none have shown detections of DBCP or EDB.

Kahului WHPA: Central Sector/Kahului Aquifer System

The 1997 Maui study had identified that DBCP had been detected in the two wells in this area. As described in Chapter 4-3, the area is not currently in use and information on previous land uses were not available. The primary source of the DBCP contamination is attributed to pineapple production activities outside the WHPA and its ten year time of travel boundary. Since, these wells, Reynolds Foods 1 and 2, have been taken out of service.

Untreated water quality data from public water supply wells was used for Table 5-4.h. This table describes the status of the aquifers in tracking contamination concentrations from volatile organic chemicals (VOC), synthetic organic chemical (SOC), nitrates (NO₂), and EDB and DBCP. Of the 2 wells identified in this area:

- ☐ none have shown detections of VOCs;
- ☐ none have shown detections of SOC's;
- ☐ both have shown detections of nitrates; and
- ☐ both have shown detections of DBCP and have been taken out of service

East Maui WHPA: Central Sector/Paia and Makawao Aquifer Systems

The 1997 Maui study had identified two wells, Hamakuapoko 1 and 2, with detection of DBCP and EDB in excess of the state drinking water standard. These wells were proposed for drinking water use but have been taken out of consideration because of persistent DBCP levels. The other well, Haiku well, is not currently in use but is proposed for drinking water purposes.

Untreated water quality data from public water supply wells was used for Table 5-4.i This table describes the status of the aquifers in tracking contamination concentrations from volatile organic chemicals (VOC), synthetic organic chemical (SOC), nitrates (NO₂), and EDB and DBCP. Of the 3 wells identified in this area:

- ☐ none have shown detections of VOCs;
- ☐ none have shown detections of SOC's;



C nitrate data was unavailable; and
C two have shown detections of DBCP and EDB and have been taken out of consideration as a proposed drinking water source.

Table 5-4.h Aquifer Monitoring Data

Hydrogeologic Setting
Spatial Description (optional)
Map Available (optional)
Data Reporting Period

Island of Maui, Central Maui Wellhead protection Area: Central: Kahului Aquifer System
Refer to Table 5.F
Refer to Map 5.4
October 1995 for the wellhead assessment; September 1997 for current monitoring data

Monitoring Data Type	Total No. of Wells Used in the Assessment ⁽⁵⁾	Parameter Groups	Number of Wells								
			No detections of parameters above MDLs or background levels		Nitrate concentrations range from background levels to less than or equal to 5 mg/l No detections or parameters other than nitrate above MDLs or background levels and/or located in areas that are sensitive or vulnerable		Nitrate ranges from greater than 5 to less than or equal to 10 mg/l Other parameters are detected at concentrations exceeding the MDL but are less than or equal to the MCLs ⁽¹⁰⁾	Parameters are detected at concentrations exceeding the MCLs ⁽¹¹⁾	Number of Wells Removed from service ⁽¹²⁾	Number of Wells Requiring Special Treatment ⁽¹³⁾	Background parameters exceed MCLs ⁽¹⁴⁾
			ND ⁽⁶⁾	Number of wells in sensitive or vulnerable areas (optional) ⁽⁷⁾	Nitrate # 5 mg/l VOC, SOC, and Other parameters not detected ⁽⁸⁾	Number of wells in sensitive or vulnerable areas (optional) ⁽⁹⁾					
Ambient Monitoring Network (optional)		VOC									
		SOC ⁽¹⁵⁾									
		NO ₂									
		Other ⁽¹⁶⁾									
Untreated Water Quality Data from Public Water Supply Wells	2	VOC	2		2/2		0	0	0	0	0
	2	SOC ⁽¹⁵⁾	2		2/2		0	0	0	0	0
	2	NO ₂	0		2		0	0	0	0	0
	2	Other DBCP EDB	0 2		2/2 2/0		0 0	0 0	0 2	0 0	0 0
Finished Water Quality Data from Public Water Supply Wells		VOC									
		SOC ⁽¹⁵⁾									
		NO ₂									
		Other ⁽¹⁶⁾									

Major uses of the aquifer or hydrologic unit	<input checked="" type="checkbox"/> Public water supply	<input type="checkbox"/> Irrigation	<input type="checkbox"/> Commercial	<input type="checkbox"/> Mining	<input type="checkbox"/> Baseflow Maintenance
	<input type="checkbox"/> Private water supply	<input type="checkbox"/> Thermoelectric	<input type="checkbox"/> Livestock	<input type="checkbox"/> Industrial	
Uses affected by water quality problems (optional) ⁽⁸⁾	<input type="checkbox"/> Public water supply	<input type="checkbox"/> Irrigation	<input type="checkbox"/> Commercial	<input type="checkbox"/> Mining	<input type="checkbox"/> Baseflow Maintenance
	<input type="checkbox"/> Private water supply	<input type="checkbox"/> Thermoelectric	<input type="checkbox"/> Livestock	<input type="checkbox"/> Industrial	

Table 5-4.i Aquifer Monitoring Data

Hydrogeologic Setting
Spatial Description (optional)
Map Available (optional)
Data Reporting Period

Island of Maui, East Maui Wellhead protection Area: Central: Paia/Makawao Aquifer Systems
Refer to Table 5.F
Refer to Map 5.4
October 1995 for the wellhead assessment; September 1997 for current monitoring data

Monitoring Data Type	Total No. of Wells Used in the Assessment ⁽⁵⁾	Parameter Groups	Number of Wells								
			No detections of parameters above MDLs or background levels		Nitrate concentrations range from background levels to less than or equal to 5 mg/l No detections or parameters other than nitrate above MDLs or background levels and/or located in areas that are sensitive or vulnerable		Nitrate ranges from greater than 5 to less than or equal to 10 mg/l Other parameters are detected at concentrations exceeding the MDL but are less than or equal to the MCLs ⁽¹⁰⁾	Parameters are detected at concentrations exceeding the MCLs ⁽¹¹⁾	Number of Wells Removed from service ⁽¹²⁾	Number of Wells Requiring Special Treatment ⁽¹³⁾	Background parameters exceed MCLs ⁽¹⁴⁾
			ND ⁽⁶⁾	Number of wells in sensitive or vulnerable areas (optional) ⁽⁷⁾	Nitrate # 5 mg/l VOC, SOC, and Other parameters not detected ⁽⁸⁾	Number of wells in sensitive or vulnerable areas (optional) ⁽⁹⁾					
Ambient Monitoring Network (optional)		VOC									
		SOC ⁽¹⁵⁾									
		NO ₂									
		Other ⁽¹⁶⁾									
Untreated Water Quality Data from Public Water Supply Wells*	3	VOC	3		N/A		N/A	0	Not in use	N/A	0
	3	SOC ⁽¹⁵⁾	3		N/A		N/A	0	Not in use	N/A	0
	3	NO ₂	N/A		N/A		N/A	0	Not in use	N/A	0
	3	Other DBCP EDB	1 1		N/A		N/A	2 2	Not in use	N/A	0
Finished Water Quality Data from Public Water Supply Wells		VOC									
		SOC ⁽¹⁵⁾									
		NO ₂									
		Other ⁽¹⁶⁾									

* Two wells are pending approval for use

Major uses of the aquifer or hydrologic unit	___ Public water supply	<u> I </u> Irrigation	___ Commercial	___ Mining	___ Baseflow Maintenance
	___ Private water supply	___ Thermoelectric	___ Livestock	___ Industrial	



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Uses affected by water quality problems (optional) (8)	<input type="checkbox"/> Public water supply	<input type="checkbox"/> Irrigation	<input type="checkbox"/> Commercial	<input type="checkbox"/> Mining	<input type="checkbox"/> Baseflow Maintenance
	<input type="checkbox"/> Private water supply	<input type="checkbox"/> Thermoelectric	<input type="checkbox"/> Livestock	<input type="checkbox"/> Industrial	



Notes:

1. John F. Mink and Lau, L. Stephen, Aquifer Identification and Classification etal: Groundwater Protection Strategy for Hawaii, Technical Reports Nos 179, 185-187, 190-191.
2. Ibid
3. Oki, Delwyn, L. Stephen Lau, John F. Mink, Wellhead Protection Methodology For Hawaii, WRRC, Special Report 01.31:92, April 1992.
4. Horsley & Witten, Ground-water Hydrology, Contamination, and Management: Final Report on the Demonstration Project Conducted on Molokai, Hawaii, December 1992
5. Hagemann, Matthew and Glen Fukunaga, A Demonstration Project to Estimate the Vulnerability of Central Oahu's Groundwater to Anthropogenic Contaminants, October 1995.
6. Hagemann, Matthew, Glen Fukunaga, Maui County Board of Water Supply, The Vulnerability of Groundwater to Anthropogenic Contaminants on the Island of Maui, Hawaii, April 1997.
7. DOH, 1997 Groundwater Contamination Maps For The State of Hawaii
8. Ibid.
9. Ibid.
10. Ibid.